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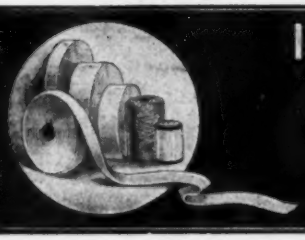

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ELECTRICAL REVIEW.

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TEACHING THE TRUTH.

THE presidential address of Mr. W. L. Hichens to the Economic Science Section of the British Association was, as we remarked, one of several attempts that have recently been made to explain to the workers, and to the general public, the operation of the laws which govern business enterprises. Sir W. J. Noble, in a letter published in *The Times* of September 17th, urged all employers to summon their workpeople together, and to impart to them knowledge of economic truths. Sir Alfred Yarrow, in a recent issue of the same newspaper, contributed an important article on the industrial situation, showing the urgent need for our being able to sell our goods to other countries in order to be able to buy from abroad the five days' supplies which every week have to be imported in order to satisfy the demands of our population for the common necessaries of life.

There can be no doubt that the greater part of labour unrest and discontent is the outcome of sheer ignorance of how things work. There are those, of course, who would destroy for destruction's sake; and there are also those who would trace, in all agitations, in every sign of difference of opinion between employers and employed, the subtle hand of the destroyer. It is, however, ignorance that leads to the supposition that restriction of output brings about prosperity in the shape of high wages. The trade unionist—we have heard him—says: "There are bootmakers out of work because too many boots have been made. Don't make so many, and spread the work out, and so employment will last longer." If he could realise that such restriction of output put up the price of boots, not only by the extra amount paid in wages for each pair, which would, generally speaking, be in direct proportion, but also by an entirely disproportionate amount of standing charges which can only be absorbed by the product, he would see that less boots than ever could be bought. For this reason demand would fall, and a vicious circle would be set up which could only be broken down by a complete reversal of the methods adopted in the hope of improving matters. Let boots—or any other manufactured product—be sufficiently cheap, and more can be sold. Individual consumers will buy more freely, and more buyers will arise, so that trade will increase to a greater extent than the prices have fallen. With increase of trade, both employment and profits will increase.

Again, knowledge of the truth would dispel the fallacy that the whole of the difference between cost of production and selling price is profit. Of the selling price of a piece of electrical machinery, only a small part consists of direct labour in the works of the electrical manufacturer. He has to buy his laminations from the sheet-iron worker, his insulated wire from the copper wire manufacturer, his insulating material from the paper mill, rubber factory, or porcelain works, his castings from the foundry—the list could be extended indefinitely. Workers in all those industries have to be paid, standing charges on all those factories have to be met, the capital employed has to be paid for, before the workman in the electrical factory can do a hand's turn at the final product. And when the machine stands on the floor of the factory, complete and ready to be dispatched, it cannot be sold for the amount it has cost up to that moment. There are the overhead expenses of the factory itself to be met—rent, rates and taxes, cost of power, cost of supervision, maintenance, tendering and selling, accounting and collecting, provision for replacement of plant, for bad debts, and numerous other things which will occur to the minds of our readers. All these

must be paid in full before investors of capital receive a penny. Yet labour frequently supposes that the rewards of capital are disproportionately large as compared with those of labour. The truth is that the amount paid in direct wages exceeds, many times over, the amount distributed in dividends and interest. The sharing of profits between employers and employed leads to insignificant benefit to the worker, while tending to reduce the reward of capital to such a point that money for investment is not forthcoming. There is a school of thought which teaches the sterility of money, and that payment for its use is wrong. No system that has yet been evolved provides any satisfactory alternative. The confiscation of accumulated wealth leads to the state of things now seen in Russia, whose starving millions would gladly grow corn enough for themselves and to send us in exchange for agricultural machinery, were there any means of organising and utilising their efforts. Without one of two things, a regular income or some accumulated capital, it is impossible to live from day to day. The wage-earner, in normal times, has continuity of employment, and a regular income in the form of wages; the individual trader has to pay those wages and to maintain himself through bad times as well as good, and if his banking account will not stand it, he goes to the wall. The Russian peasant has no accumulated wealth, and since there is no one left to pay him a regular wage, he starves to death.

This is no time for sticking at details. When business, as now, is not obtainable at prices which will allow of the payment of the present rates of wages, even when profits and standing charges are neglected, then wages must come down. The situation now is that export business cannot be obtained at anything above the bare cost of material and labour, and unless matters speedily improve the same will be true of the home trade. Trade union restrictions must go. Demarcation between trades has been carried to an absurdity, and even when there was work for all they were definitely injurious. In these days of scarcity, the extra cost of calling in extra workmen to finish off a job that one workman of average ability could do by himself, is often sufficient to prevent the job from being done at all.

Workers to-day would be well advised to devote their attention to work. We cannot get orders at the present high costs. The demand for goods exists—we referred months ago to Sir Robert Hadfield's statement that there is a world hunger for steel. There is a world hunger for everything that can be manufactured, but it must be satisfied at the prices people can afford to pay.

The Work of the Electricity Commissioners.

That the Electricity Commissioners did not suffer from lack of occupation during the first 14 months of their constitution was generally understood; the proof is now in our hands in the shape of their first annual report, a perusal of which compels the conclusion that they must have been amongst the busiest men in the Kingdom during the period concerned. Unfortunately that period ended six months ago, so that many matters which were under consideration are only dealt with fully up to the point they had then reached, though in some cases the course of subsequent events is briefly indicated in foot-notes. An abstract of the voluminous record is commenced elsewhere in this issue.

Apart from an historical *résumé* of the development of the electricity supply industry in this country up to and including the appointment of the Commissioners, the report consists of a mass of detail under numerous sub-heads. Referring to the reorganisation of the supply of electricity, the prime motive of their constitution, the Commissioners regretfully remark that progress in this direction must be gradual, and that in view of the innumerable difficulties in the way, the high hopes of the Electric Power Supply Committee are not likely to be realised as rapidly as was anticipated. The principal obstacle is, of course, the scarcity of funds, and this will probably keep the brake on progress for some years to come. Reasons are also given for the delays inseparable from the procedure laid down by the Act of 1919 in connection with the initiation of new schemes for electricity districts, from which it appears that even in the most favourable circumstances, considerable time must elapse between the provisional determination of a district and the approval by Parliament of a scheme for the district. This is cold comfort for the many districts which have not yet got beyond the stage of delimitation. However, the Commissioners are doing their best to shorten the proceedings, to induce promoters and objectors to curb their appetite for desultory debate at the inquiries, and to reduce the second local inquiry required in each case to a formality.

Into the record of achievement we can scarcely dip without going overhead; but we may note that the Commissioners have authorised the erection of new generating stations having an initial capacity of 150,000 kW, and extensions of existing stations aggregating 547,000 kW; they have sanctioned expenditure by municipal authorities exceeding 15 millions sterling, and numerous schemes for mutual assistance, and they have carried out an immense amount of routine administrative work, as well as their advisory duties in connection with the Ministry of Transport.

One of the strongest features of the system created by the appointment of the Electricity Commissioners is the fact that they are not political heads of departments, at the mercy of permanent officials—mere figure-heads; they are themselves the active working officials, informed with knowledge and experience of the position and needs of the industry, and keenly anxious to promote the interests of the industry together with those of the public. They have many difficulties to contend with, not a few of which are legacies from past legislation which, owing to the exigencies of parliamentary procedure, they have not yet been able to remedy, and a somewhat plaintive note of restiveness is here and there discernible in the report. But they have bent themselves to their Herculean task with a zeal and energy that compel admiration, and a courtesy and consideration that win the goodwill of those who come in contact with them; and in congratulating them upon the record of their first year's work, we may add an expression of confidence in the successful outcome of their efforts to reorganise and uplift the industry of electricity supply.

Charges for Supply and Industrial Councils.

No. 5 District Industrial Council (West Midlands area) is urging the various District Councils and the National Council to press for statutory powers to be conferred on the Ministry of Transport, so that in granting any Order authorising increased maximum prices to undertakings it can make it conditional on the undertakers giving effect to all the recommendations of their District Industrial Council. The intention of No. 5 Council is commendable enough, but what it proposes is obviously out of the question. Nothing can be done in this way, of course, except by Act of Parliament, and it is clearly outside practical politics that an Act of Parliament should be passed giving the Minister of Transport power and responsibility with regard to wages in the electricity supply industry, and this only in respect of those undertakings which required an increase of price, leaving the rest of the industry outside his purview. Again, it is difficult to see how an Order could be made "conditional" upon such an indefinite qualification as fulfilling the recommendations of a District Council. As a matter of fact, the whole matter had already engaged the attention of the National Council, with the result that the Ministry of Transport pointed out that everything reasonable had been done to safeguard the interests of the District Councils through the special provision by which the District Councils were given a status for making representations whenever any

undertaking applied for increase of maximum price. The Ministry referred to the satisfactory working of this arrangement, and clearly intimated that the further suggestion would not receive support.

As the matter stands at present, the payment of wages according to the District Councils' schedule is one of the factors which is taken into account by the Electricity Commissioners when granting an increase of price, and so far the Electricity Commissioners have done everything in their power to support the payment of wages according to the schedules of District Councils.

No. 5 Council also includes in its proposal a suggestion that some means shall be devised whereby "Industrial Councils can give effective support to applications from undertakers for orders to increase maximum prices where it appears that without such increase authorities are unable to pay standard rates or observe standard conditions without incurring a loss on working." The exact bearing of this is somewhat enigmatic, but it is obvious that No. 5 Council thinks that if it could give what it calls "effective support" better maximum prices would be got than are obtainable at present. The Council can, of course, support any application made for an increase in charges, and this is taken into account by the Electricity Commissioners. The further implication in the words "effective support," therefore, does not, we think, carry a proper suggestion, seeing that every case is most fully gone into by the Electricity Commissioners, who already take into account the representations of District Councils. There are, obviously, certain cases where the Commissioners' hands are tied by existing legislation, and where they cannot give increases of price adequately to meet the needs of an undertaking; but no amount of "effective support" can alter this. Everyone knows that the Commissioners themselves deplore their inability as much as anybody, but until further legislation is passed nothing can be done. Altogether, although we sympathise with the objects of both of the suggestions made by No. 5 District Council, we are afraid it has not yet found out a practicable path towards the ends in view.

Gas on Trains.

It is satisfactory to observe that the French Government has decided that the use of gas as an illuminant on railway trains must come to an end. The Minister of Public Works and Transport, M. le Trocquer, has issued a circular which decrees that before January 1st, 1923, gas lighting on express trains must have entirely disappeared. On suburban trains, electricity must be the sole lighting agency by the beginning of 1924, and in another year, or by January 1st, 1925, all other trains must be lit by electricity. A similar step was contemplated in 1914, but action was delayed by the war.

The Batignolles tunnel disaster, where two crowded trains collided, and were then set on fire through the ignition of gas from a tank broken in the collision, has been the means of teaching a lesson which has been promptly taken to heart. As a result, in three years from the end of the present year, it will be impossible for such a catastrophe to occur in France. The use of double-decked steam railway carriages is, fortunately, not common in this country, the Mumbles Railway, which consists of a train of tramcars drawn by a steam locomotive, being the only example that occurs to us.

Fire as a concomitant of railway disasters, however, is by no means unknown in Great Britain, and it is obvious that if gas is used on trains it stands a great chance of being ignited. This risk should long ago have made the British Government take the necessary action to compel its abolition. There is no reason for the use of gas, for the Great Northern Railway has equipped a restaurant train with electric cooking devices. All railways should follow that example, and a time limit for the accomplishment of the change should be fixed.

We should not advocate Government action but for the fact that uniformity is unlikely to be attained without it. While the boards of railway companies include influential gas magnates, such individuals will advocate the use of gas for lighting and cooking. The furthering of the exclusive use of electricity for these purposes on trains is a line of action that might very well be pressed by the British Electrical Development Association.

The Norwegian Electrochemical Industry.

The question of the resumption of production by the electrochemical works in Norway is now under consideration. Only a few of the 15 works were kept in operation during the past summer, as difficulties were encountered in effecting sales, together with exchange problems and economic troubles in the case of some works. It is, however, now considered desirable to restart activity, but the first condition lies in a reduction of the costs of production. The existing wages agreement, which expired on July 1st, 1921, rendered it impossible to work at a profit, and negotiations for a new agreement are expected to begin when the work of mediation in the cases of the sawmill and paper trade disputes has been concluded. If the wages question can be satisfactorily solved, it is calculated that all the carbide works, aluminium works, &c., including the Odda works, will again be brought into operation. As for the latter, it is stated that the works cannot come into activity again unless the companies obtain facilities for raising a loan of £600,000 in England, and work in this direction is said to be proceeding with the support of the State Department of Finance.

The German Insulating Tube Syndicate.

We recently referred to the contract conditions of German syndicates, which compel their customers to accept delivery at any time suitable to the former, and at prices prevailing on the day of delivery, so that customers are at the complete mercy of the members of the syndicates. One of the latter was the Sales Bureau of the United Insulating Tube Manufacturers, the managers of which have since issued a reply to the charge of an abuse of their powers. They state that the members of the syndicate are compelled to impose such conditions as they themselves are bound by similar and, in some cases, by more strict conditions by the firms which supply them with raw materials for the manufacture of the tubes. Under the circumstances the tube makers claim to be in a position of defence in order to be protected against possible sudden changes subsequently and of losses of millions of marks; and they expect their customers in turn to exercise the necessary precaution for themselves in relation to their own clients. The syndicate draws attention to a report by the Berlin Chamber of Commerce in support of its policy. This report states that the course taken by the manufacturers of insulating tubes in 1919, and down to April in 1920, was extremely difficult both with regard to the acquisition of raw materials and in the matter of prices paid for them. Merchants suffered in common with makers and were only able to supply their customers in accordance with the deliveries on the part of producers and at the market prices at any time fixed by the latter. No trade custom, the Chamber remarks, has developed in the tube industry which would justify the purchaser in cancelling an order entered into at non-binding prices. It is not usual in the insulating tube trade for the seller to inform the buyer of increases in prices before each delivery, and for the latter to refuse acceptance owing to the advance in prices, although a year may elapse between the placing of the order and the delivery, and prices in the meantime may have materially increased.

A German newspaper comment on the attitude of the syndicate is that the rights are all on the side of the tube makers, whereas they ought to be divided between the latter and their customers, and that if profiteering is avoided by makers a return to normal conditions will be facilitated.

D

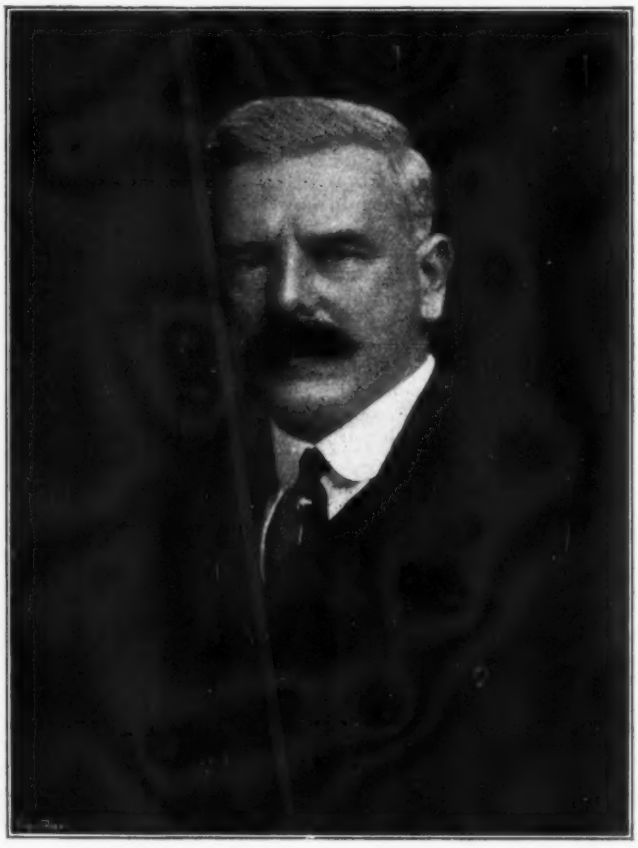
JOHN SOMERVILLE HIGHFIELD, M.I.E.E., M.Inst.C.E.,

President of the Institution of Electrical Engineers, Session 1921-22.

To a great many people the happy coincidence of event with circumstance—as for instance when Christmas presents happen to arrive on Christmas Day—is always a source of satisfaction.

The Institution of Electrical Engineers has every reason to be satisfied that the circumstance of its year of Jubilee should coincide with the attainment not only of a Royal Charter, but of the patronage of the King as well.

The timing of this event is really more of a coincidence than the result of deliberate design, yet nothing else could so fitly celebrate the close of 50 years of the Institution's existence. The desire for a Royal Charter, in place of its then company constitution, loomed large in Mr. Wordingham's presidential programme, but circumstances prevented both him and his successor from doing more than discuss the scope and aims of the proposed charter. It has remained for Mr. Atkinson and his Council to crown a very strenuous and successful term of office by securing the double advantage to the Institution of a Royal Charter coupled with Royal patronage. The Institution has reason to be proud of the conduct, by its Past-President and Honorary Treasurer, of the negotiations, extending over several months, which have in so short a time, and at the end of a long and tiring parliamentary session, led to so satisfactory a result. Had a single set-back occurred in the sequence of negotiations, official investigations and formalities necessary to the granting of the Charter, the coincidence of Jubilee year with Charter would have been impossible.



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JOHN SOMERVILLE HIGHFIELD.

Mr. J. S. Highfield, on taking over office on October 1st, stepped into this inheritance. It is appropriate that as chairman of the General Purposes Committee, to which the question of the Charter was referred by the Council, he has had an important share in framing the measure which will be completed during his presidency, for the Institution has to draft and submit to the Privy Council the By-laws under which it is henceforward to work.

And again, the Institution may be congratulated that such a task is in the hands of a President who not only is aware of, but may be counted on to use, all the experience on the question that has been accumulated during the past few years.

Mr. Highfield comes of engineering stock, his grandfather having been a civil engineer. Before he went to King's College, London, for his academic training in science and engineering, he passed much of his boyhood in the atmosphere of the workshop and the laboratory, making with his father, who was an enthusiastic amateur mechanic and chemist, all sorts of mechanical and electrical apparatus, the two of them filling the house with ingenious devices. Among other things they built a sailing boat, and thus early laid the foundation of that intimate knowledge of sailorcraft which provides the President with much of his recreation, and the ability to attack engineering problems from the sailor's point of view—often the simplest and soundest point of view. It has been said that if the President were wrecked on a desert island he would build a boat and make a sail for it before he built a hut to live in.

At King's College he was a student under John Hopkinson, and at the end of the course remained as his demonstrator and research assistant for another year.

After some time with the Chloride Electrical Storage Co., where he was able to practise on a large scale much of the battery work he had done as a boy in his father's workshop, Mr. Highfield got drawn into the electricity supply industry. First at Stafford and then at St. Helens he applied the principles in which he had been so thoroughly well grounded under Dr. John Hopkinson.

At Stafford he designed the Highfield booster, which added greatly to the life and usefulness of secondary batteries on variable loads, and although a more rapid reversal than the Highfield principle permits is now available, for all but the most rapid load reversals the Highfield booster still provides a complete automatic control for secondary batteries. The most interesting application of the booster was in connection with the City & South London Railway—the first genuine electric railway—when it was worked on Hopkinson's 5-wire direct-current system.

Mr. Highfield's most important electricity supply work was done with the Metropolitan Electric Supply Co. First as chief engineer and next as engineer and manager, he from the start adopted the principle of concentrating the generating plant at the Willesden station coupled with the shutting-down of the plants scattered over the supply area. In the first three years of his service with the Metropolitan Co. he increased their profits by £100,000. Mr. Highfield still holds the position of consulting engineer to the Metropolitan Electric Supply Co.

Great Britain became wealthy when she developed her overseas trade. On the security of that overseas trade her population increased far beyond the capacity of Great Britain to supply that population with food,

and our present troubles from unemployment are largely due to the failure of that overseas trade.

The art of successful trading probably demands as much imagination and invention in its votaries as the art of architecture, though the imagination is of a different order, but outside the body of traders themselves the British community understands very little about trade. Mr. Highfield has always been a student of the art of trading, and has applied its principles to trading in electricity. At the present time, when electricity supply and its future conduct are occupying the time and thought of the industry and of the Government department set up to improve it, his paper on "The Supply of Electricity," read before the Society of Arts in May, 1919, is a contribution to the subject which will repay careful study. The principles of trading in electricity there laid down are the results of the President's experience with the Metropolitan Electric Supply Co. and the Cornwall Electric Power Co.

From the supplier's point of view the Cornwall Electric Power Act is the most comprehensive in the country since the Power Co. can both supply and distribute all over the county with the exception of two boroughs. As their consulting engineer, Mr. Highfield designed their power station at Hayle and the overhead transmission system. The company paid a handsome dividend in the second year of its existence.

Monsieur Thury's system of high-pressure direct-current transmission, with the motors of the sub-station motor-generators in series, made a deep impression on Mr. Highfield. He read three papers on the Thury system before meetings of the Institution—in London, in Glasgow, and in Paris—and installed a section as part of the Metropolitan Electric Supply Co.'s system. But reasons other than its technical success or otherwise determined the fate of the Thury system in this country, successful as it had been and still is in the Rhone Valley. The Thury system of high-pressure direct-current transmission is only one application of the high-pressure direct-current principle, and Mr. Highfield and his brother have never ceased to work at other applications. Should their present efforts be crowned with success several difficulties inherent in 3-phase transmission would be overcome, and the cost of transmission, which now bulks so largely in the price of electricity when distances are measured in scores of miles, would be materially reduced.

His knowledge of the sea naturally led Mr. Highfield, during the war, to devote his energies to submarine detection, his work resulting in a towed "fish" for sound detection by hydrophone and a siren above audible frequency for detection by echo. These devices may have no permanent application, but in another field he established an experimental factory for the electrolytic purification of clays in the colloid state, which may ultimately have many commercial applications. The method was devised, however, as a war measure to help the glass industry, seriously handicapped by the want of suitable clay crucibles.

The President has already served three terms as a member of the Council of the Institution. His term of office as a vice-president was divided into two periods by the rule governing the retirement of vice-presidents which happily gives both himself and the Institution the advantage, which he would not otherwise have had, of stepping from Vice-President to President, familiar with the last Council and its work.

Mr. Highfield's position and experience as an engineer and as a man of affairs, and his long service on the Council, fit him in every way for the responsible and arduous post of President of the Institution. He can feel assured of the sympathetic good wishes of the industry during his term of office, and of the co-operation of all those, his fellow workers in electrical engineering, who wish well to the use and development of electricity in this country, the importance of which has so recently been recognised by the State through the patronage of the Institution by the King and by the granting of a Royal Charter by his Privy Council.

ELECTRICITY IN ISOLATED BUILDINGS.

By E. H. FREEMAN.

It is unnecessary to-day to argue in favour of the use of electricity in town buildings where a supply is available from street mains. The matter has been discussed and settled long ago, and the only deterrent is the cost of installation, which will gradually be reduced so that electric lighting and heating will be practicable for any type or size of dwelling. It is, however, not always realised how much stronger the arguments become when the case of the isolated building, remote from the amenities of town life, is considered. Difficulties of water supply; the waste and work involved in keeping a kitchen range burning all day to boil the afternoon tea kettle; servant troubles; cost of decorations, and many other daily trials, are all really arguments in favour of an electrical installation. Once a supply is available the pumping can be carried out by power—direct from the engine or from a motor; the tea kettle can be boiled from the battery; house work is eased by the use of a vacuum cleaner or an electric iron; labour is saved by the abolition of paraffin lamps and the reduced dust from fires; and redecorating can be put off another year or two without loss of self respect.

These points have all carried weight in the past, but the electrical plant has been regarded as a luxury, to be installed in the large country mansion, and treated as out of the question for the smaller house or farm in which 60 to 80 lights represents the total connected load. Increased cost of labour, fuel, and other essentials is, however, gradually bringing home to these smaller users the fact that the electric light plant is an economy in the long run, and some consideration as to the details of the most suitable installation may, therefore, not be amiss.

Ignoring the rare occasions when reliable water power is available, the prospective purchaser is at once faced with a host of alternatives. Is the fuel to be paraffin,

Fig. 1.—A Country House Lighted with Electricity.

petrol, crude oil, or gas? Is he to install an automatic, semi-automatic, or non-automatic plant? Is a vertical high-speed engine better than a horizontal low-speed engine of the type with which he is often already more or less familiar. These and many other questions are difficult problems for the non-technical buyer—and often for the experienced engineer as well, for that matter.

As regards fuel, it is very unlikely that gas will be available in an isolated building such as is being considered. If it is, part of the argument for the electrical plant disappears, but if gas is available the gas engine will usually be found most convenient, being lower in first cost and generally cheaper to run than the oil engine. If a gas supply is not available, the relative advantages of petrol, paraffin, and crude oil need consideration as, for such small plants, suction gas or steam will rarely be found advantageous. For engines of, say, 10 h.p. and over, crude oil will probably be best; the running costs in this case are less than with the paraffin engine, and the saving in fuel will pay for the extra initial cost, with interest and depreciation, within a few years. With the smaller engines with which we are mainly concerned, however, the advantage is not so great. The difference in first cost is less, and there is frequently difficulty in obtaining small supplies of crude oil. The cost of fuel per annum is also so small in any case that it is not worth while adopting the more economical engine. Petrol is probably never likely to be adopted unless one of the small automatic or semi-automatic plants is installed. The petrol engine is certainly more expensive for fuel than the paraffin engine, and also has more wear and tear, as it is generally a high-speed engine. There is also some risk of fire with a petrol-driven set. The engine room may be left closed for hours at a time with the engine running, and a very small leak may cause an explosive mixture. Whilst it is impossible to lay down any hard-and-fast rule, it is probable that paraffin will be found most convenient for the great majority of installations.

The next important point is the type of plant to be adopted—automatic, semi-automatic, or non-automatic. With the first type the engine is usually started and stopped entirely by automatic devices on the switchboard; with the second the set is started when desired off the battery, by a push button, and frequently stopped automatically at the completion of the charge; with the third type the entire control is by hand. The last of these has been almost universally adopted until the last few years. Several makes of automatic and semi-automatic plants have been on the market for years, but although large numbers have been installed the non-automatic plant has held the field. Of late, however, there has been a large increase in the number of automatic sets on the market, many of them of American origin, and the advisability of adopting such plants needs consideration.

At first sight such sets seem very tempting, particularly to the non-technical buyer. The "you-touch-the-button-and-we-do-the-rest" principle seems to provide a simple solution to the difficulty of having a man of some sort to run the plant. Then the whole plant is delivered "complete" and the advertisements give the impression that the ordering of the plant completes the lighting installation. The position is, however, not quite so simple as the advertisements imply. The advantages of such plants are of the obvious kind, and are largely advertised, but one does not hear so much about the other side of the picture. A full automatic plant of what may be regarded as the normal type is designed to run the load direct off the engine. It includes a battery often of comparatively small capacity which is only used when two or three lights are in use, except for starting up the engine by motoring the dynamo. This it does automatically when the battery voltage drops below a fixed minimum. Several technical objections to such a plant are obvious. The engine must be large enough to deal with the maximum possible load for considerable periods. The average load is, however, not more than 30 per cent. to 40 per cent. of this, and the engine will therefore, be working most of the time on this small

Fig. 2.

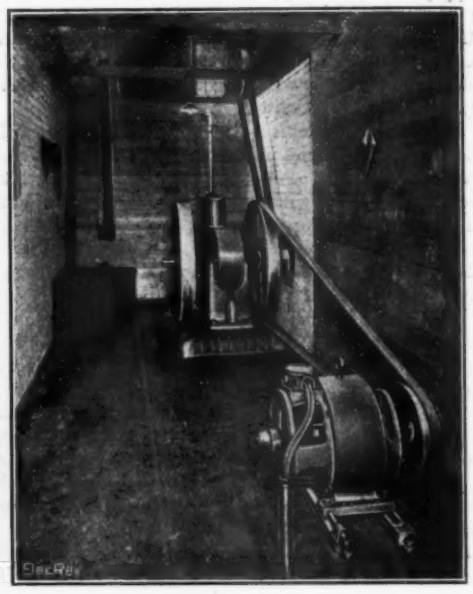


Fig. 3.

Figs. 2 and 3.—Engine House, with Saw-bench driven from the Engine.

Fig. 4.—Engine House and Battery Room.

output. No engine can do its best under such conditions. Governing (and voltage regulation) will be bad, and the engine is likely to soot up and give trouble from this cause sooner or later. The plant will also be called on at times—for example, during most of the afternoon on a dull winter day—to run with only five or six lights in use out of, say, 50 or 60. Such a load is rather too much for the battery, but too small for the engine, and the plant is apt to alternate between starting and stopping with considerable strain on the battery, and much jumpiness of light due to the frequent and heavy variations in voltage. The strain on the battery also must obviously be severe, as the worst load, that of motoring the dynamo to start the engine, only comes on when the battery voltage is low, *i.e.*, when the battery is practically discharged and should have no further discharge at all.

These opinions, based rather on theoretical considerations than on actual experience, are supported by the fact that many of the makers of automatic plants have recently increased the capacity of the battery supplied—in some cases to a considerable extent—with the result that the apparent saving in first cost is now very small if it exists at all. In spite of the increased capacity, however, it is to be expected that the life of the battery of an automatic plant will be much less than with one hand-controlled.

Some of these objections apply more or less to the semi-automatic plants. Most of these are arranged for starting up off the battery by motoring the dynamo, with hand-operated push-button control, and for automatic stopping of the engine on completion of the charge. There is no objection to the latter point except the difficulty of tuning up a single defective cell, or of regulating the voltage to suit the load or the state of the battery. The other devices are, however, likely to cause trouble though probably to a less extent than with the full automatic plant. A careful user will see that the battery is not fully discharged before starting up the engine, and there is, therefore, less strain on the battery, and a probable longer life. On the other hand, the regular failure to discharge the battery fully will gradually cause reduction in its capacity.

There is a further objection to both types of plant, namely, the difficulty of arranging for the occasional over-charge of the battery that is essential to its proper operation. This can, of course, be done with either type of plant, but only by hand control, and once this is admitted to be necessary, say, once a month or more, the full claims of automatic working disappear. This applies both to the automatic and the semi-automatic type of plant as this overcharge can only be given by cutting out the stopping device which is common to both.

Apart from all these technical objections, there is the generally admitted fact that small automatic devices are best avoided. Such plants as those under consideration are often used very intermittently. The small country house is shut for the winter, or the farm uses practically no light in the summer, and in such conditions automatic gear does not have a fair chance. The attendant also relies too fully on the magic word "automatic," and forgets the necessity of lubrication, fuel supply, and general cleaning.

On the whole, the writer is of opinion that the older type of plant with a standard horizontal paraffin engine, a belt-driven dynamo, and a storage battery of capacity to run the load for two or three evenings, will still be found the best in the long run. Small engines such as we are considering can be started up in quite a short time, and once started, can be left on charge with very little attention. The attendant will know fairly closely, from the ampere-hour meter and by experience, when the charge will be complete, and need not, of course, wait in the engine room all the time. The engine will always be running at practically full load under the best possible conditions, and this fully compensates for the loss of efficiency in taking all the load through the battery.

Such plants should have a switchboard with an ample number of stops for the battery charge and discharge switch—seven or eight for a 50-volt and twelve to fourteen for a 100-volt installation—and an automatic cut-in and cut-out switch in the battery circuit. The battery should, of course, be fixed adjacent to the engine and not at the house, as proper attention to the battery is almost impossible with the latter arrangement.

Regulation of voltage by a booster would not be worth while on small plants, but it is possible that an adjustable series resistance in place of end-cell regulation might be worth while in some cases. It would make the battery charge and discharge switch unnecessary, whilst the adjustable resistance could be placed in the house and the voltage at the lamps regulated without any attendance being required at the engine room.

A comparison of costs will show that there is no material advantage in favour of the automatic or semi-automatic plants.

It will be seen that the prices of plants of different makes vary considerably, as might be expected, but many points need consideration as well as mere cost. The non-automatic plant covers a really reliable installation with all accessories, however, and its cost compares quite favourably with that of other types. Erection costs are probably rather heavier, but not seriously so, as it is, of course, necessary to provide proper foundations and housing even for the tiniest plant.

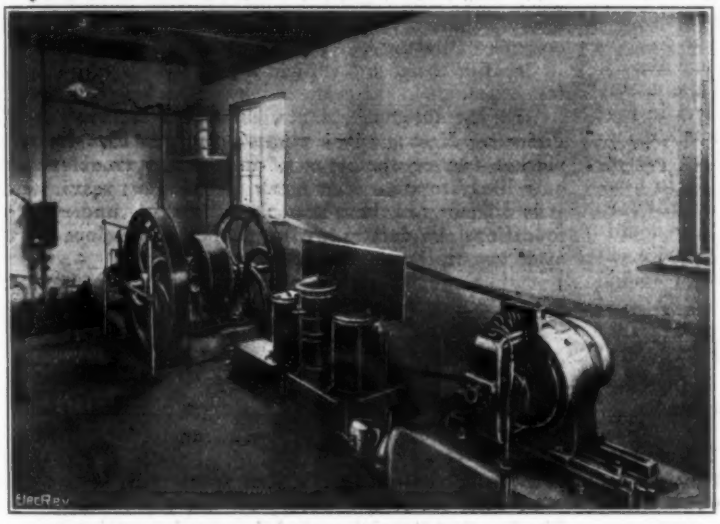


Fig. 5.—A Well-arranged Oil-electric Plant.

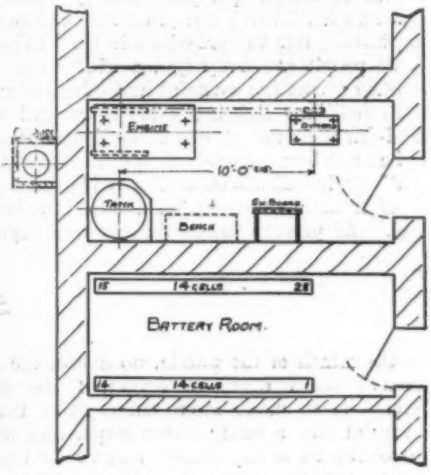


Fig. 6.—Electrical Plant Installed in an Existing Building.

ELECTRICITY IN ISOLATED BUILDINGS.

Estimated Costs of Plant (Not Erected).

Ref.	Type of plant.	Volt.	Engine output, h.p.	Dyn. output, Watts.	Bat. cap., amp. hrs.	Total cost. £	Fuel.
A	Automatic	50	—	800	—	306	Petrol
B	Automatic	50	—	1900	—	408	Petrol
C	Automatic	100	—	800	—	367	Petrol
D	Automatic	100	—	1900	—	485	Petrol
E	Automatic	32	3	1250	225	230	Paraffin
F	Automatic	25	—	750	126	148	Petrol
G	Automatic	50	—	750	60	162	Petrol
H	Automatic	100	—	2000	140	480	Petrol
J	Automatic	100	—	3600	230	654	Petrol
K	Automatic	100	—	3100	216	664	Paraffin
L	Semi-automatic	32	—	750	80	143	Paraffin
M	Semi-auto. or hand oper.	25	2	750	120	185	Petrol
N	Semi-auto. or hand oper.	50	5	1500	120	270	Paraffin
O	Semi-auto. or hand oper.	100	5	2500	120	394	Paraffin
P	Semi-automatic	25	1½	750	72	145	Paraffin
Q	Semi-automatic	50	2½	1000	72	192	Paraffin
R	Semi-automatic	50	3½	1500	120	269	Paraffin
S	Semi-auto. or hand oper.	50	3½	1500	145	264	Petrol or Paraffin
T	Semi-auto. or hand oper.	25	1½	750	72	141	Petrol or Paraffin
U	Semi-automatic	32	2½	1250	115	174	Petrol
V	Non-automatic	50	2½	1700	108	210	Paraffin
W	Non-automatic	100	2½	1800	70	250	Paraffin
X	Non-automatic	50	4	2250	180	300	Paraffin
Y	Non-automatic	100	3½	2200	108	340	Paraffin

Note.—Details of engine, dynamo, and battery sizes are as advertised by makers. Where these are not stated the particulars are not given by the makers.

The question of running cost is not a serious item compared with the convenience. In pre-war days an analysis of a considerable number of records showed that a shilling a light per year usually covered the cost of fuel and lubricating oil. Accurate estimates are almost impossible, due to variations in the habits of the users. Some people are away in the winter and others in the summer; some are wasteful and others economical; some want brilliant lighting everywhere and others prefer semi-darkness except where the light is actually in use. It has not been possible to obtain accurate records for post-war installations, and even if available they would be of little use, due to the fluctuations in the price of fuel. At present prices the pre-war experience would mean a cost for fuel and consumable stores of about 3s. to 5s. per light per year—or, on, say, a 50-light installation, £8 to £12 per year. Interest and depreciation would be several times this amount. The complete installation would amount to some such figure as £400, and interest must be taken as 7 per cent. and depreciation at least 8 per cent. on the average, corresponding to an annual charge of £60. Fuel costs are obviously of minor importance.

The cost per unit is of secondary importance, but may be of interest. Pre-war records showed that the average consumption of energy, for lighting only, varied from 4 units to 8 units per light per year. On these figures the total consumption for a 50-light installation might be anywhere between 200 and 400 units, corresponding to a cost, on the figures given earlier, of about 8d. to 9d. per unit for fuel. As this excludes interest and depreciation and attendance it will be obvious that if a supply from external mains can be obtained it will be advisable to adopt it rather than to install a private plant, even at charges per unit well above those ruling in most country towns.

The question of maintenance must also be considered, but it is difficult to get any reliable figures for this. There are plenty of records for the non-automatic plants which show that, if instructions are followed, an ordinary gardener, without any previous experience, can run such plants, with a few hours' attention per week, for scarcely any cost apart from fuel and consumable stores. Two such plants, recently overhauled after the war, have worked for ten years or more with a total maintenance expenditure, apart from fuel, of under £5 on each of them. The batteries still have years of life in front of them, and engines and dynamos are in perfect order.

With the automatic plants, however, details are more difficult. Most of these plants have only been on the market two or three years, and battery troubles are only likely to arise after a few (a very few) years' use. It is difficult to believe that plants working under such conditions can fail to involve heavy maintenance costs after two or three years' working.

(To be concluded.)

STAINLESS STEEL.

In the minds of the public, no doubt, the impression is firmly rooted that the principal use of "stainless steel" is to make table knives; but this interesting material has a vastly wider scope, and with a view to dispelling false impressions and imparting a just sense of its possibilities, last week Messrs. Thomas Firth and Sons, Ltd., Sheffield, gave a demonstration of its behaviour in the form of turbine blading, and in other applications. Incidentally, it may be pointed out that stainless steel is not, as many suppose, a recent invention; it originated in the Brown-Firth Research Laboratories, which are jointly owned by Messrs. John Brown and Co., Ltd., and Messrs. Thomas Firth & Sons, Ltd., as long ago as 1913, when Mr. Harry Brearley, who was in charge of the laboratories, reported that low-carbon high-cromium steel, which was being considered for rifle barrels and inner gun tubes, had been found to have unexpected anti-corrosive properties. "Highly polished pieces which have been exposed to the atmosphere in the chemical laboratory for two or three weeks remain perfectly bright, whereas ordinary mild steel becomes quite rusty." It could also be hardened and softened, and "would appear, therefore, to be especially well suited for the manufacture of spindles (hardened), gas and water meters, pistons and plungers for pumps, ventilators and valves for gas engines, blades for turbines," &c. This was indeed a prophetic statement, betraying remarkable insight into the future. In the course of a brief lecture by Dr. W. H. Hatfield, the present head of the Brown-Firth Research Laboratories, the properties and characteristics of stainless steel were described, and it was shown by ocular demonstration that not only all the articles mentioned by Mr. Brearley, but many more, such as saws, fenders, frying-pans, golf-club heads, stair-rods, surgical instruments, &c., had been made of the steel that never tarnishes.

Of chief interest, however, was the turbine blading. The fact that "stainless steel" resisted corrosion under conditions similar to those obtaining in a turbine had long ago suggested that it would be suitable for this purpose, and the idea was put to the test in the power house of Messrs. Firth & Sons' Tinsley works; a 2,000-kW Westinghouse turbine, running at 3,000 r.p.m., was installed in August, 1916, and has been in regular use since then, with steam at 200 lb. per sq. in., superheated to about 600 deg. F. A number of experimental blades were fitted in the turbine on June 11th, 1920. Alongside of the blades of stainless steel there were fitted, for comparison purposes, a number of new blades of the standard type supplied by the makers, of 5 per cent. nickel steel. The details of the experimental blades fitted are as follows:—

In wheel No. 8, situated at the low-pressure end of the turbine, were fitted 12 new blades, three of stainless steel, highly polished, with three of stainless steel unpolished alongside of them. On the opposite side of the same wheel, three more of stainless steel unpolished, with three standard blades alongside. These blades are 7 in. long by ¾ in. wide, the diameter of the wheel being 4 ft. 1½ in.

In the velocity wheel, at the high-pressure end of the turbine, were fitted 24 new blades. On one side of the wheel 12 of stainless steel unpolished, and on the opposite side six of stainless steel unpolished, with three

of stainless steel highly polished, and three standard blades alongside. These blades are $\frac{7}{8}$ in. long by $\frac{3}{4}$ in. wide, and the wheel is 3 ft. $7\frac{1}{2}$ in. in diameter.

The conditions of the velocity wheel are typical of those with dry steam at a high temperature, and the conditions at wheel No. 8 are typical of very wet steam.

photograph, whilst in fig. 2 they are as opened out. Fig. 3 shows stainless steel turbine blades as opened out, and the photograph clearly shows the difference in the response to both corrosion and erosion when comparison is made with the adjoining nickel steel blades.

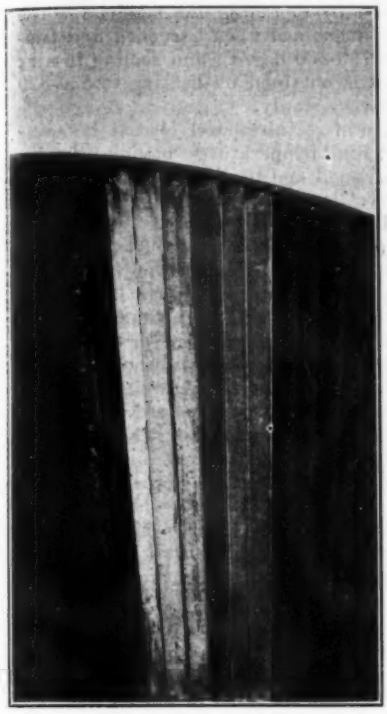


Fig. 1.

Fig. 2.

Fig. 3.

Stainless Steel Turbine Blades after 16 Months' Service.

The work done by this generating set since the fitting of the new blades is represented by a run of 3,471 hours, with a demand averaging a 50 per cent. load. The appearance of the blades on opening up the turbine has to be seen in order to be properly appreciated. Whilst the standard blades have corroded in the usual way, the stainless ones, both polished and unpolished, are practically untouched and retain their original brightness. What discoloration has appeared is probably due to rust carried over from the other blades, as shown by the fast that it washes off with a damp rag.

In fig. 1 is reproduced a photograph showing three unpolished and three polished stainless blades after 15 months in service. Fig. 2 shows three of the unpolished stainless blades and three ordinary composition nickel steel ones put in new into the turbine at the same time as the stainless blades. In fig. 1 the blades have been rubbed with a damp cloth prior to the taking of the

The stainless steel contained 0.30 per cent. carbon and 13.4 per cent. chromium; whilst the nickel steel contained 0.19 per cent. carbon and 4.71 per cent. nickel.

The mechanical properties of the two steels as placed in the turbine are given in the following table:—

	Nickel.	Stainless.
Yield-point, tons/sq. in. ...	25.2	44.1
Max. stress, tons/sq. in. ...	34.7	54.5
Elongation, per cent.	32.0	20.0
Red. of area, per cent. ...	61.0	59.7
Brinell hardness number ...	149.0	255.0

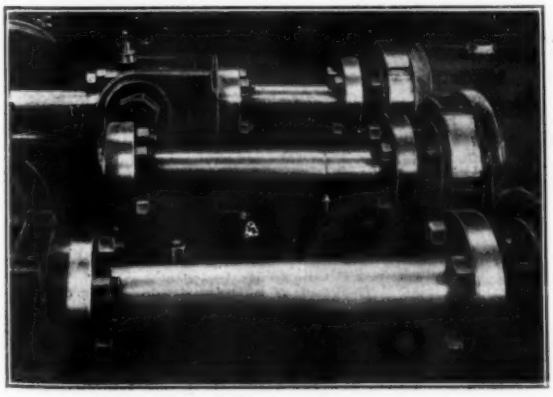


Fig. 4.—Stainless Steel Pump Rod.
The arrow shows ridge on non-ferrous alloy rod.

Fig. 5.

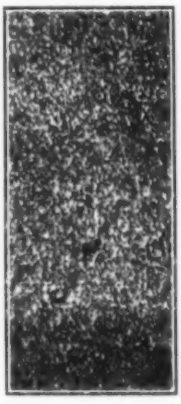


Fig. 6.

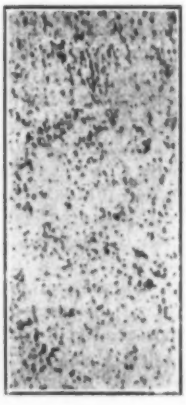


Fig. 7.

Photomicrographs of Nickel and Stainless Steel.
(× 500 diameters.)

The microstructure of the blades is reproduced in the accompanying photomicrographs, figs. 5 and 6, which are both at 500 diameters. It will be seen that the nickel steel is in the soft condition and consists of ferrite holding nickel in solution, with a little pearlite running through it. The stainless steel (fig. 6) is seen to consist

of fine-grained structure resulting from the effect of tempering upon the hardened condition. Fig. 7 shows the structure of stainless steel when hardened.

The experiment shows that the introduction of stainless steel for use in turbine blading will be of great advantage, and it is quite clear that improved efficiency, due to the retention of a clean, smooth surface on the blades, and the saving of time and of awkward situations by the avoidance of shutting down for repairs, reblading, cleaning, &c., will be of direct interest to turbine engineers.

Through the courtesy of Mr. Samuelson, of the British Thomson-Houston Co., the results of a similar experiment performed in connection with one of the B.T.H. turbines have been made available. Early in 1916, the company had one wheel bladed with five different kinds of material, the object being to find out which of these would best stand up against the action of the steam. The row of blades selected was situated at about the middle of the machine, where indications of erosion and corrosion had frequently been seen. The blading materials selected were phosphor-bronze, nickel-bronze, brass, mild steel, and stainless steel (two hardened and two hardened and tempered stainless blades were inserted). The machine was put into service in the autumn of 1916, and was opened up for examination for the first time in April, 1918. The inside of the machine was found to be perfectly clean, and all blading in good condition. A certain amount of erosion was visible on all the trial blades except those made of non-rusting steel; the brass blades seemed to have suffered most. There were no marks whatever on the stainless steel, while the mild steel blade edges were rough; phosphor-bronze and nickel-bronze seemed to have the same resisting quality to the action of the steam and moisture.

The machine was then closed up and again put into service, and was opened up a second time for examination in July, 1921, when the inspection confirmed the previous conclusion, *i.e.*, that the stainless steel blades were in very good condition and absolutely unaffected, the edges being as sharp as when put in, and there was apparently no difference between the hardened and unhardened samples. The phosphor-bronze, nickel-bronze, and brass blades were all roughened at the entrance edge, and very little difference was noted between them. The mild steel blades were badly roughened, and the entrance edge was worn away nearly 1/16th of an inch. "As far as resisting properties are concerned," says Mr. Samuelson, "the stainless steel is very superior to any other blading material which we have so far tried."

Another interesting experiment was performed by Messrs. Thomas Firth & Sons with a three-throw electrically-driven hydraulic pump manufactured by Messrs. Davy Bros., Ltd., Sheffield, working at a pressure of 1,800 lb. per sq. in., and installed in 1915. One ram was made of stainless steel, the other two being of the standard non-ferrous alloy used by the makers. This pump ran continuously—night and day—until the termination of the war. The wear on the stainless ram was 1/64th of an inch on the diameter, whilst in the case of the non-ferrous rams it reached so high a figure as 7/64ths of an inch. Fig. 4 illustrates the present condition of these rods. The less wear upon the stainless rod means much in saving wear of the packing.

Stainless steel is an alloy containing about 12 to 14 per cent. of chromium, and can be hardened in air, oil, or water, the hardening temperature being not 760 or 780 deg. C. as in the case of ordinary carbon steel, but 950 to 1,000 deg. (orange yellow). The electric furnace is particularly well suited for the production of stainless steel, owing to the highly reducing and basic conditions, keeping phosphorus and sulphur down, and the high temperature ensuring clean ingots, free from flaws. The steel is unaffected by most acids, exceptions being citric, formic, and sulphuric; running water, moist air, &c., have no effect on it. The steel scales less than other steels at high temperatures. Up to a temperature of 800 deg. C. only superficial colour effects are observed. It is noteworthy that the colour changes in tempering occur at much higher temperatures than in the case of carbon steels. The thermal conductivity of stainless steel is less than a third of that of pure iron. The best results are obtained with polished surfaces, but this is not necessary for the material to be rust-resisting; grinding should be done with water, as the stainless property is impaired by scorching the material. The steel is most readily machined when hardened and tempered by heating to 750-800 deg. C. and cooling in air; the softest condition is obtained by heating to 850-870 deg. C. and cooling very slowly.

A valuable feature of stainless steel is that it maintains its strength at high temperatures, having a breaking stress, when hardened and tempered, of 87 tons per sq. in. at 500 deg. C. It also offers a high resistance to fatigue when tested by the usual methods.

Since our visit to the works, Messrs. Thomas Firth and Sons have informed us that one of their customers has furnished data with regard to stainless steel blades 28 in. in length, which have been in constant service in one of his turbines during the last four or five years, and have given entire satisfaction. This example proves that long blades of this material can withstand the vibratory stresses to which they are exposed.

It will be seen, therefore, that Messrs. Thomas Firth and Sons are to be congratulated on the invention and development of a material possessing properties of the first importance to the engineering world, and that Sheffield has once again justified her position at the head of the world's steel-making industry.

THE PRESENT NEEDS OF THE BRITISH ENGINEERING INDUSTRY.

A WHOLE-DAY conference of members of the British Engineers' Association was held on Wednesday, October 19th, at the Hotel Victoria, London, to discuss "The Problem of Restoring Vitality to the Engineering Industry." Mr. Nevile Gwynne, president, was in the chair.

Among those present at the conference were: The Rt. Hon. Lord Weir of Eastwood, Mr. E. W. Petter, chairman of the Executive Committee, Mr. D. A. Bremner, director, Sir John Cowan, Sir James Kemnal, Sir John E. Thornycroft, K.B.E., Sir R. Ashton Lister, M.P., and Sir Wilfred Stokes, K.B.E.

Between the morning and afternoon sessions of the conference, luncheon was served, and an important speech on the industrial situation and the questions before the conference was made by Lord Weir.

The conference, after full discussion, forwarded to the Prime Minister a memorandum, recording its considered opinion that the following are essential features and conditions of a national effort to restore prosperity to the engineering industry:—

1. The loyal co-operation of labour in a great national effort to revitalise our industries and commerce which are the only possible sources of its own well-being.
2. The repudiation by the trade unions of the declared policy of their extremist sections to render the system of capitalism and private enterprise unworkable.
3. The institution of compulsory secret ballots by the trade unions.
4. The reduction of cost of production by amending the conditions affecting the output per £ of wages paid.
5. The careful consideration of a national trade policy more in consonance with the new conditions with respect to foreign competition in our home market and the raising of tariff walls abroad tending to shut out our exports.
6. The development of the home market and the confinement to this country of contracts involving the expenditure of public moneys.
7. The development of markets within the Empire.
8. National economy.
9. Reduced taxation of wealth productive industries.
10. Unemployment relief work to be of a reproductive nature to the greatest extent practicable.
11. The payment of doles uncompensated by work done to be reduced to the minimum.
12. Cheaper coal, valued in terms of heat units.
13. Due consideration to be paid by the Government to the possible effects upon industry of a policy of deflation.

14. The taking of drastic measures to reduce the cost of living in so far as it may be due to profiteering by the few at the expense of the many.

15. A more complete and better organisation of industry for its good government from within.

In the opening sentences of his speech, Lord Weir said he spoke not as a politician nor as an economist, but as a manufacturer and an engineer. He congratulated the Association on holding the conference. Such action was very significant, because it disclosed its appreciation of the gravity of the situation and its recognition that success could only emerge through unity of effort and policy, and he took it that the conference was the first step toward formulating an engineering policy. He went on to refer to the infinite variety of the factors involved in the present situation, and added that no single course of action by itself could bring about any immediate cure. He was neither a pessimist nor an optimist, but he was sure that no British engineer who was aware of the past history of British engineering and the technical position of the craft, could fail to be confident in the tremendous recuperative power of the industry. The patient was sick—maybe very ill indeed—but his constitution was a sound one. He had had far too many doctors in the last few years and far too many patent medicines. The organs were all right, and no operations were required. In Scotland they had cured many cases by the cold-water cure, and perhaps some such treatment was required by industry to-day. The problem before them was how best to restore vitality to the engineering industry to assure that orders would revive as insufficient orders were being received to give employment to the workers. Russia and other countries were not buying. New enterprise was taking a rest until prices fell. Countries able to buy were not buying from us because our prices were artificially high. There was a certain amount of foreign trade definitely available and we were not getting it. There was also home trade available, but home firms were not getting that. In the expectation of reduction of price, customers at home, in the Empire, and abroad were restricting and postponing their demands. Belgium took the recent order for Chinese locomotives and rolling-stock, and under to-day's conditions in this country, he failed to see why Belgium should not take the next Chinese order. Again, during the last nine months we in this country bought £19,000,000 worth of iron and steel from abroad. Infinitely more serious and more significant was the fact that during September, 1921, we bought more iron and steel from abroad than ever we had done in the past history of this country.

He desired to ask those who were supposed to lead us to answer the following question: "Which is the best statesmanship, to grant British credit or British guarantees of credit to a foreign country, yes, even to a British colony, to enable it to purchase from Glasgow a huge bridge, which will be built of imported steel, or to tell the British steelmaker and his workers that these credits and guarantees will be withheld until the steelmaker and his workers can arrange between themselves to produce that steel at home and give the necessary employment?"

The Labour Party's programme for unemployment called on the Government to provide either work or maintenance. Apart from the underlying fallacy that a Government could ever carry the community on its back, in contradistinction to the real truth that the community carried the Government, such a suggestion would apparently work out as follows: Under it we should have a local authority relief scheme in Lanarkshire giving unproductive and inefficient employment to miners, ironworkers, and labourers, working alongside closed pits and closed iron works, while Glasgow harbour was filled with vessels bringing in imported foreign iron, smelted with foreign coal. That was the type of ineffectual and purblind policy which appeared likely to emerge from the manner in which one heard the Government proposed to deal with the situation. The main question was one of the conditions governing the costs of production in the different countries, and it applied not only to the most highly specialised manufactures, but to the lowliest domestic commodities. British employment would be governed by the cost of British production. Apart from wage rates, wage costs were inflated to-day by unjustifiable working conditions. These excess costs were brought about by a network of conditions which had grown up during the last few years as a result of trade union pressure exercised in one form or another. All of them had definitely increased costs. Against this he failed to find a solitary example of trade union action or suggestion to secure any decrease in costs. The trade union attitude always appeared to be based on the assumption that the profit of the manufacturer was sufficient to provide for all these alleged improved conditions, or that they could be passed on to the consumer in the price. The existing state of the industry proved that both assumptions were wrong. The trade unions forgot that we were no longer the only industrial nation, that we must not only sell abroad, but that our home market was an open one.

Lord Weir said it was his conviction that very few yet fully realised the true incidence of the shorter working week on costs and prices, and the extent to which this single item had contributed to produce to-day's situation. After assuming the enormous burdens placed on us by the war and the further burdens on our industry brought about by the dislocation of world trade, it was difficult to see how we were warranted in agreeing to assume not only the burden of a 15 per cent. increase in wage rates per hour, but the further burden of additional capital charges to enable output to be produced in the shorter period, the additional oncost charges, and the very miscellaneous mass of increases brought about in different industries by two men being required in place of one, and by three shifts in place of two.

He estimated the increase in cost of British products last year due to the shortened week at over £200,000,000. Output had gone down approximately in proportion to the hours. To reduce costs in a normal year by £200,000,000 without affecting weekly earnings would be the most direct and immediately effective help which could be given to many of our industries to-day.

The speaker went on to refer to the obstruction to systems of remuneration by result, the rules and regulations affecting overtime and night shift working, and other matters which, if abolished, would effect a substantial reduction in the cost of a British working hour without affecting the worker's pay.

If the abolition of restrictive conditions were now discussed with the trade unions in a spirit of frankness, and an agreement was reached, any further wage rate reductions should be viewed in association with the cost of living, subject, of course, to the possibility of drastic economic difficulties intervening to prevent this. Since the armistice the controlling authorities on the costs of production had been the Government and those who had led trade union policy. It was obvious that that control should have been exercised by the two real authorities, the employers and their men. The Government had practically abolished its control. Those who guided the workers' policy had not. The industrial performance of the country was now a lamentable one. Labour as a political movement looked to the Government to revive trade. They would be disappointed, because no Government could revive trade. On the employers and the workers rested the main responsibility of trade restoration, and on their combined performance employment depended. He believed that were the Government to declare what it already knew—that the power of trade unionism used by the men who now controlled it for purely political purposes had become a tyranny and a menace to the workers themselves, that it was bidding fair to ruin the industrial position, and with it the well-being of the people of this country, and that recognising this it had determined that the exercise of this power for evil should be curtailed and restricted—that it would rally to its support and assistance multitudes who were silently suffering at this moment and looking for a banner under which to struggle for their freedom.

INDUSTRIAL RESEARCH.

The Progress Report of the British Electrical and Allied Industries Research Association for the September quarter gives particulars of the several important industrial researches carried out under the direction of that body. The work of the Association is conducted by committees under eleven sections, and the Report indicates progress in each of these.

In Section A (Fibrous Insulating Materials) the results of the classification of users' requirements have shown that two grades of treated fabric are sufficient to meet all ordinary demands. For fabrics of the higher grade, which have hitherto been purchased on a basis of price, breakdown voltage, and appearance, the Committee is developing better technical criteria. Tests under working conditions are yielding data which will define the fundamental constants of these materials. Improved test methods for untreated papers have been evolved as a result of experiments, and these are to form the basis of a specification. Researches on fibres and boards have been undertaken under three heads—press-board (including presspahn), varnish-paper products, and vulcanised fibre. Experiments on press-board have indicated the best methods for testing, and these will form the basis of a forthcoming specification. The corresponding work on the two other classes of material is scarcely so advanced.

The experimental work on composite insulating materials (Section B) has so far progressed as to enable a specification to be drafted. This embodies the results obtained on the important mechanical and electrical properties, but inflammability, machining qualities, and certain other properties are still under investigation. A comprehensive research on porcelain, with particular reference to insulation resistance, improvement of surface, and dielectric strength is being pursued, with the co-operation of the G.P.O. and of the manufacturers. Samples have been obtained from the former showing surface deposits which adversely affect the insulating properties, whilst the latter are invited to submit samples for resistivity and electric strength tests, including resistivity tests at high temperatures.

In the section dealing with mica, classification is completed, and the Committee will carry out further detailed researches on the various qualities, in co-operation with the Committee of the new Section L. A report will shortly be ready on the use of mica for commutators and condensers; the experimental work on the abrasive hardness of mica is not yet completed, however.

Numerous researches on insulating oils, referred to in the

last report, are still under way. The study of resistivity in relation to moisture content and dielectric strength has necessitated comprehensive research, particularly as certain new facts arising from the investigations require further consideration. The provisional specification for insulating oils drawn up and submitted to the B.E.S.A. has called forth suggested improvements which are being dealt with.

In Section F (Conductors), work on buried cables at the N.P.L. and at Newcastle will shortly be reviewed. There has been some delay, due to the necessity of carrying out tests on finished cables instead of component parts, as originally intended. The work on overhead line conductors, and on the strength of wooden poles, is nearing the report stage.

The Committee of Section G (Electric Control Apparatus) has several most important researches in hand. The work on the rupturing capacity of oil circuit breakers has been mapped out, and an adaptable model switch and certain sensitive recorders have been specially designed for this programme. The Home Office at Eskmeals, and the N.P.L., still continue the research on the pressures developed in switch chambers by gaseous explosions and the rupturing of electric circuits. From the critical examination of available data on heavy duty fusible cutouts, a research programme on these heavy-duty fuses is being built up.

Direct-current circuit breakers have been the subject of extensive inquiries, which only emphasise the lack of fundamental data on this subject. However, with such material as is available, it is hoped to make a commencement of practical tests. The electrical engineers of the L.C.C. and L. and N.W. Railway, and other users and manufacturers are co-operating in this work. The extensive work on joints and contacts already done at the N.P.L. and elsewhere is being supplemented by a study of heavily loaded joints existing in various installations.

The Association is participating in the research on the corrosion of condensers by the Corrosion Committee of the Institute of Metals. It is expected shortly to issue an explanatory report of the results so far obtained, and steps are being taken to bring manufacturers into closer touch with the investigators during the experimental work. In the same way, it is intended to keep manufacturers in close touch with the experimental work on turbine nozzles (under Section J) now proceeding at the College of Technology, Manchester. It is hoped to extend this work to the question of temperature distribution on turbines, and to new investigations on the properties of steam. Blading materials are already being tested under working conditions by manufacturers co-operating with the N.P.L.

A conference of the Committee of Section K (synthetic resins) has been held with various Government Departments, through the instrumentality of the Department of Scientific and Industrial Research, and a good understanding of the requirements for different purposes arrived at. Other aspects of the use of synthetic resins, with which this Committee is dealing, are: the provision of adequate supplies at all times, moulded synthetic resins, and the properties of materials of synthetic resin with a fibrous support. The work of all the Committees dealing with insulation is being reviewed and co-ordinated by the Committee of Section L, which deals with dielectrics in general, and supersedes the old Joint Committee on Dielectric Losses and Allied Phenomena.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS FOR SEPTEMBER, 1921.

The returns of electrical business during September show increased totals in all sections. In the case of the exports the value increased from £1,284,511 in August to £1,305,550 in the month under review, while the imports reached a total of £178,900, as compared with £140,334 in the previous month. The re-exports total of £17,300 is an advance of £2,800 on the August figures.

In the export section the business in telegraphic and telephonic material and apparatus showed an increase of £55,000. Batteries, meters, and insulated wire also reached higher values, but there was a falling off in the sections for electrical goods (£17,000), in lamps (£10,000), and in electrical machinery (£25,000).

In the imports increased values are recorded in all sections with the exception of meters.

The accompanying tables of electrical exports for the first nine months of 1913, 1920, and 1921 show gross totals of £5,433,676 for 1913, £9,603,279 for 1920, and £14,294,881 for 1921; the monthly averages are £603,000 for 1913, £1,067,000 for 1920, and £1,588,320 for 1921. The total number of electric glow lamps exported during the first nine months of 1913 was 2,329,587, as compared with 3,387,688 in 1920 and 3,683,407 for the same period in 1921.

The total weight of electrical machinery exports for January to September of 1913, 1920, and 1921 were 20,167 tons, 7,621 tons, and 14,195 tons respectively.

Totals of Electrical Exports for the First Nine Months of 1913, 1920, and 1921.

	1913. £	1920. £	1921 £
Electrical goods and apparatus	678,727	1,366,347	1,633,607
Insulated wire	750,303	2,773,116	2,661,565
Glow lamps	114,453	193,602	368,268
Arc lamps and posts	39,875	25,803	17,574
Batteries	185,887	399,191	558,276
Meters	132,956	294,072	386,991
Carbons	8,239	80,158	56,595
Electrical machinery	1,669,287	1,690,903	3,846,238
Telegraph and telephone material, apparatus, &c. ...	1,853,949	2,780,087	4,765,767
	5,433,676	9,603,279	14,294,881

Values of Electrical Exports and Imports for September, 1921.

	Exports.	Imports.	Re-exports.
Electrical goods and apparatus ...	£114,669	£35,046	£3,645
Insulated wire	227,784	15,893	98
Glow lamps	25,828	16,419	604
Arc lamps and parts	880	507	354
Batteries	55,507	6,548	10
Meters	42,601	3,243	618
Carbons	1,767	14,746	1,376
Electrical machinery :—			
Railway and tramway motors ...	19,304	—	—
Other motors and generators ...	212,430	—	—
Switchboards (not telegraph or telephone)	27,703	8,346	—
Electrical machinery (unenumerated)	149,049	55,187	3,693
Telegraph and telephone cable and material :—			
Telegraph and telephone wires and cable (not submarine) ...	175,899	4,598	—
Submarine telegraph and telephone cable	56,502	—	—
Telegraph and telephone instruments and apparatus	195,627	18,367	6,902
Totals... ...	£1,305,550	£178,900	£17,300

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Principles of Wages Determination.

In your leader on the above subject you advocate Whitleyism as the most likely method for arriving at a fair division of profits between Capital and Labour. Quite right, but let us first look at facts and see what margin there is for readjustment. Mr. F. Deutsch, Director of the A.E.G., of Berlin, presented to the Berlin Chamber of Commerce some two years ago statistics collected between 1908 and 1917 from 66 industrial companies, and he found that the average share of the profit obtained by the workers, both manual and professional, amounted to 76.7 per cent., taxation absorbed 11.7 per cent., and the capitalists' share was 11.6 per cent. Not much margin here for improving the workers' reward! But the position has worsened since the Armistice. Mr. Deutsch (as you will find in the *E.T.Z.* of October 6th) has now extended his investigations to 152 industrial companies, and finds the following ratio of division :—

Wages and salaries	84.9 per cent.
Taxes and rates	11.7 per cent.
Capital	3.4 per cent.

Practically no margin for re-adjustment. I have no similar figures for English conditions, but it seems unlikely that here the margin will be appreciably greater. Before we can talk of fair division there must be something to divide amongst State, Capital, and Labour. This means that we must remove all restrictions to the production of wealth. There are many, but I will only mention one, and that is the most potent, namely, the private ownership of the land. Wealth can only be produced by applying mental and manual labour to the natural resources found on and in the earth, which is the storehouse from which every man either directly or indirectly draws his sustenance. Free access is therefore the primary essential for improving our social conditions. By free access I do not mean that the workers should simply rob the landlord of the land he claims unconditionally to control. The cure would be worse than the evil, as we see by the present conditions of Russia. What I mean is that the holding of land should be subject to the payment of a tax assessed in relation to its value in the open market, whether the land is left idle or let or worked by the owner himself. Such a

tax can be imposed by Parliament, and in fact the 1909 Budget was a half-hearted attempt at such a policy, but it was dropped by the Liberals, and the complicated nature of the proposal with its many exemptions and restrictions would have made it unworkable. A tax if universally applied regardless of the size of the holding would not interfere with private enterprise, and would leave existing contracts undisturbed. It is true that it will require some time to get into working order, but if the nation were assured that it would be imposed without unnecessary delay, the public would very readily agree to provide (with the security of future prosperity) the necessary funds to help all industries to tide over the present time. Land value taxation is the true remedy for the social malady, and when this is achieved it will be time to talk of Whitleyism, co-operation, municipal trading or private enterprise and the fair remuneration of Capital and Labour.

Gisbert Kapp.

Birmingham.
October 22nd, 1921.

[We are inclined to think that the conciliatory spirit engendered by the practice of Whitleyism would be more likely to lead to an agreement as to equitable division of profits than would controversy on the taxation of land values.—Eds. Elec. Rev.]

"Grinding" versus "Turning" of Commutators.

Your contributor (Mr. Joseph T. Towlson) on page 461 of the Electrical Review, October 7th, commenting on Mr. Owen Linley's article, appears to favour turning as against grinding. When we read Mr. Linley's opinion in favour of grinding we thought that he was pushing at an open door, and that he was recommending a method already approved by every electrical engineer.

As inventors and makers of machines for grinding commutators and slip rings in position, we may be prejudiced, and it might be alleged that we desire a cheap advertisement in addition to our usual advertisement appearing regularly in your paper. But we think your readers are entitled to some "statements of facts" other than those given by Mr. Towlson. We therefore give you the following:—

(1) Leading manufacturing electrical engineers are our best customers.

(2) Leading electrical undertakings grind their commutators, as do leading collieries and large steel works.

(3) A commutator grinder was recently installed at Lots Road generating station.

(4) Although trade is bad, we have sold more commutator grinders during the past year than in any previous year.

(5) Our motor-driven grinder was designed at the suggestion of the Admiralty, and the four battle cruisers about to be built are to be equipped with commutator grinders.

(6) Leading electrical engineers have adopted the grinding method after trying the turning.

On the respective merits of grinding and turning it would not be decent for us to enter into controversy, although we could urge several convincing reasons in favour of the former in addition to those stated by Mr. Linley. But we think that the above "statements of facts" will be conclusive proof of the opinion held by electrical engineers.

John Phillips & Co.

London.
October 13th, 1921.

A.C. Organ Blowers.

Having had charge of several organ-blowing equipments, I have followed with much interest the correspondence on the above, but there is one type of motor which I have not seen mentioned; it really deserves to be better known. I refer to the "Bandy." The regulations as to limitation of starting current are strictly enforced here, and this motor complies with them in every respect.

There are in this town some 14 organs blown electrically, some with two, others with three feeder bellows operated by means of fast and loose pulleys, but of course the rotary blower makes much the best job. Going away from the subject for a moment, one of the characteristics of the above-mentioned motor is its wide range of speed variation, invaluable in such cases as driving printing machines.

In conclusion, while on this subject of motors, while the machines themselves are really good sound jobs, the controllers or starters leave much to be desired.

A. Brown.

Eastbourne.
October 24th, 1921.

Supply Without Statutory Powers.

Regarding Mr. Barber's doubts, the statements made were absolutely accurate. The barrowful meant 1 cwt., and the coal merchant supplying it will confirm what was written. There is nothing miraculous about it. Details herewith:—

Engine, Davey-Paxman automatic expansion, built in 1883. Maximum h.p. 14, economic h.p. 10 to 11. Running at one-third cut-off generally. Grate area 3½ sq. ft.

Coal used daily in raising steam 33 lb. (average of many careful tests). Time run, 1½ hours on 79 lb. Just at random, the coal used June 12th-25th, 1915, was 14½ cwt. in 14 days. Total coal in 1915, 45 tons. Average per kWh actually sold, 17 lb.; per kWh at generator terminals, 12 lb.

The other figures referred to, taken simply as published, are 17 and 18 lb. per unit.

I hasten to disclaim any intention of making the ridiculous suggestion that this small plant would *normally* come anywhere near the efficiency of a *modern* station of a million units annual output.

It may be of interest to add that this village supply grew up from a home-made ¼-kW overtype generator installed in a small local works in the days of the old carbon-filament lamp. The advent of the Osram lamp made it possible for the villagers to pay the inevitably high cost per kWh and still obtain cheap light, and the opportunity was immediately seized. The first engine on the job was an A type vertical steam engine, bought for £5 twenty years before.

I am sure Mr. Barber's experiences will interest many readers.

A. O. G.

October 24th, 1921.

A Suction-gas Problem.

With reference to "O. N. E. Morequery's" inquiry about the deodorising of the waste gases of a suction plant, I think if he will make inquiries of Messrs. Crossley Bros. he will get particulars of a device which they used to make for fitting on the waste-pipe chimney of producers which keeps the waste gases continually deodorised by means of a weak solution of permanganate of potash, doing away with neighbours' complaints. The great advantage of permanganate over most deodorisers is its cheapness and its lack of any smell, many deodorisers only substituting one smell for another.

He might also try the same stuff in the overflow sumps if it is worth while, it being generally considered unnecessary to consider the olfactory (or any other) sensitiveness of the engineers who look after the plant.

If your inquirer has any trouble in getting particulars of the above device, I think I can send him a sketch.

Napoleon.

October 22nd, 1921.

The E.T.U. and Station Engineers.

It may interest your readers to learn that after an investigation by the National Executive Committee of the Electrical Trades Union into the control of the London Station Engineers' Section by the District Council, they have decided to set up a Committee composed solely of station engineers with full powers of control for that section, apart from the London District Council, and subject only to the National Executive Committee.

Delta.

Cleaning Enamelled Slate.

Replying to your inquirer on the above question, I can supply a mixture that will clean and polish enamelled slates or other highly polished surfaces, and will not finger-mark. The only precaution to be taken in its use is that the surface must be cleaned with soap and water first, to remove any grease or furniture cream that has been used on it.

Rotherham. **R. E. Smith.**
October 17th, 1921.

The Contractor's Future.

Writing as a contractor, I think the last paragraph of Mr. Jeary's letter is the crux of the whole matter. To give you an instance, I was called in to undertake some wiring work for a well-known institution which is more concerned with the spiritual welfare of the people than their electrical requirements, and to my surprise, when I offered to supply lamps, I found the E.L.M.A., with its usual generosity, had graded this institution at 4 per cent. over the usual trade terms. It seems to me that in a great many cases discounts are given to users without any apparent reason, the excuse generally being that they employ an electrician on the premises; the "electrician" is often a hall porter or the boots, who can replace a fuse occasionally, and when the manufacturers wake up to the fact that the contractors will not assist them by stocking and showing goods unless these trade discounts are stopped to users, neither Mr. Hawkins nor any other factor will have much to complain of.

London. **A. G. Hudson.**
October 19th, 1921.

The Municipal Tramways Conference.

Your Editorial and your report of the above in the Review of the 7th inst. are particularly valuable at the present time when tramways are being made the target of so many ill-informed attacks, but it appears to me that very much more is needed to deal effectually with the situation.

May I quote my position—it is typical of many. As a member of a County Council owning tramways I am keenly interested in the battle of trams *v.* 'buses. Which is the

most economical, the safest, the least obstructive, the best in the public interest, from all points of view? These are the questions we have to decide, but decision is difficult. The 'bus companies loudly acclaim their vehicle, and disparage the tramcar. In this the lay Press blindly follows them. The tramway authorities mildly point out the advantage of tramcars. Two things are certain; first, the rates are being saddled with a heavy burden of road costs due to the destruction caused by 'bus traffic, whilst the tramways are unfairly burdened with heavy charges for road construction and maintenance; secondly, tramways undoubtedly keep down fares; this in these days of gigantic traffic trusts is something. But the point is that we want something more. We need straight, skilled and unbiased information. Cannot the Institution of Electrical Engineers do something? I suggest that it set up a committee, one capable of going right to the root of the matter, and issue a report in terms of passenger-miles—not vehicles—get at all the costs, hidden and otherwise. What does a 'bus cost in road destruction? What is the true cost of running a tramway, including fair road charges? What are the relations of the 'bus companies to the trusts, and how would these operate if tramcars were withdrawn? These and many other points need clearing up, and if the Institution could see its way to undertake such a work it would undoubtedly serve a great public need.

William B. Pinching, A.M.I.E.E.,
Member Middlesex County Council, &c.

London.
October 17th, 1921.

The Durability of Lead-covered Wiring.

If "W. T. J." had given the reasons advanced (if any) by his practical electrician friend, as to what was likely to cause the deterioration of the lead covering in six or seven years' time, one could have dealt with his question better. Vague statements are always difficult to controvert or confirm. I cannot imagine anything in an ordinary private-house installation which would bring about such a condition, provided the wiring was properly installed and efficiently bonded. Apart from mechanical strength, lead is surely one of the most durable metals—if not *the* most durable. It is used for roofing, stained-glass windows, and in many similarly exposed situations. Hundreds of examples probably exist to-day in ancient buildings, where the original lead is intact after being so exposed for anything from a century upwards. The lead composition water pipes in my house are about 30 years old, and are as good to-day as when they were first put in. In the large suite of offices where I write this letter, the staff lavatory—an eternally moist place—is wired with the Henley wiring system, the sheathing of which is lead composition. That installation was put in nine years ago, and the sheathing is as good to-day as it ever was. It shows not the slightest signs of any deterioration, and, from its appearance, seems likely to rival Tennyson's babbling brook, which, your readers will remember, "goes on for ever."

I have personal knowledge of many other installations on the Henley wiring system which were put in 10 years ago, when this system was introduced, and which are perfect to-day, and these installations comprise a great variety of types of buildings embracing all sorts of conditions. For many years before then, lead-covered wires and cables were installed, and are still in use. In tunnels, cellars, and such places, where there is no risk of mechanical damage, unprotected lead-covered cables, large and small, for all sort of amperages and pressures, have been in use for very many years.

It would be interesting to have some evidence adduced by "W. T. J.'s" practical electrician of where, and under what conditions, lead-covered cables or wires are reputed to fail in a few years. If such is not forthcoming, one can but assume that the statement has been made, as are many others of a like nature, on mere supposition and from personal prejudice.

Othello.

October 19th, 1921.

"W. T. J." asks, in your issue of the 14th inst., for opinions on the durability of this wiring. I can tell him that I have used it in several large buildings in Calcutta with complete success. These installations have been in use for seven years at least. In cases where trouble has occurred I have always found it due to failure (or omission) of the earthing connections. This earthing is a *sine qua non* for metal-sheathed (especially lead sheathed) systems, and is provided for in the I.E.E. Wiring Rules, Nos. 66 and 68.

Teddington. **A. K. Taylor, M.I.E.E.**
October 18th, 1921.

This system properly installed forms one of the most durable and cheapest house wiring installations that can be devised. The lead casing is ordinarily incorrodible and immune from chemical and electrolytic attack, neither is it affected by damp or exposure to the atmosphere.

The weak points (as with most other systems) are at the ends of the wires, as at the fittings, &c., and therefore suitable connection boxes should be provided wherever these occur in damp places, but they are usually not necessary in small house installations.

Efficient bonding and earthing is a vital factor of success, and unfortunately this is very often scamped in the smaller wiring installations; also a number of cases have been found where the wiring has been very carefully bonded, but no connections (or very inefficient ones) have been made to earth.

In cases where this has been neglected and small leakages have occurred, faults have been caused by the current travelling along the lead casings to the nearest earths (usually damp places), and electrolytic action has thus been set up at these places (there being generally enough acid drawn from the building materials), the lead casings being eaten away, thus allowing the v.i.r. to be attacked and breakdowns caused. The above actions can be very easily and cheaply avoided by careful attention to the bonding and earthing of the installations. These actions have been probably the cause of the majority of the failures that have occurred on lead wiring installations.

Fred. T. Alldread.

London.
October 22nd, 1921.

Referring to the above subject, it is quite possible that the practical electrician referred to by "W. T. J." was quite correct in his estimation. With regard to Mr. O. Skidmore's "ten minutes' practical thinking," it is obvious that not more than ten minutes *has* been given to this very important subject. Thus: (1) Lead piping used for gas lighting is not subject to electrolytic action, due to stray currents. (2) If the G.P.O. did not take particular care to bond the lead sheathing to some good earth connection, the lead would deteriorate accordingly. (3) If particular care was not taken with the e.h.p. mains, the action of stray currents would occur. It is understood that little trouble *is* experienced in this country from this effect, but that does not signify that it does not happen.

In my experience, corrosion only occurs at the points at which the leakage current leaves the cable, and not at the entering points; the lead being as it were carried away by the current.

G. White.

Bendby.
October 22nd, 1921.

With reference to your correspondent's inquiry, having had considerable experience of various systems of wiring, I would by no means condemn high-grade lead-sheathed cable for house wiring purposes, but would say that the sheathing should consist of pure lead and not be alloyed with other metals.

I have just carried out some minor repairs in a large building in which lead-sheathed cable had been used almost throughout; on examination the sheathing showed no signs of deterioration, and the insulation test on the cable was good.

In view of the fact that the wiring referred to was installed in 1903, it cannot be said that six or seven years is the life of lead-sheathed cable; but in my opinion solid-drawn conduit and high-grade v.i.r. cable are undoubtedly the most reliable job.

However, lead-sheathed cable is a good alternative, and it is much easier to install than conduit; so I would advise "W. T. J." to go ahead with his installation, but let him be sure to use high-grade material, as it is cheapest in the long run. I quite agree with Mr. O. Skidmore's observations.

Contractor's Foreman.

October 24th, 1921.

Gas v. Electricity.

We should be very pleased if any of your readers could supply us with information concerning the cost of running gas-heated furnaces for the heat-treatment of steel.

What we desire to know is what the number of cubic feet of gas amounts to per pound of steel treated.

We have already some information upon this point, and so far have found that the cost of gas heating invariably exceeds the cost of heating by electricity.

There may, however, be on the market a gas furnace more economical than any that we have yet met with, in which case we should like to hear of it.

E. P. Barfield,
Managing Director,
Automatic & Electric Furnaces, Ltd.

London.
October 20th, 1921.

Battery Carbons.

In the "Business Notes" column of your issue of 21st inst. you reproduce an article which appeared in the *Evening Standard* of the 14th inst. on the subject of "Making Industry Safe." We could afford to ignore the article in your lay contemporary, because everyone makes charitable allowance for the shortcomings and inaccuracies of articles on technical subjects in the lay Press. When, however, the Electrical Review gives publicity to a statement that the

pocket battery trade depends upon imported small carbon rods, it is time we entered a protest.

Immediately upon the outbreak of the late war we took up the manufacture of these small carbon rods, and achieved an enormous output, running into a million a week. Our carbons are at least as good as anything that can be imported, and our prices bear comparison with those of foreign goods.

We have facilities for producing sufficient carbons to meet the entire home demand and providing a substantial surplus for export.

Under these circumstances, you will agree that the statement appearing in the *Evening Standard* is quite inaccurate.

S. Beeton,
Director, Morgan Crucible Co., Ltd.

London.
October 24th, 1921.

[On reference to the note, it will be seen that we said the secretary of the Electrical Importers' and Traders' Association was credited with the remarks in question; and the later quotation on the same subject emanated directly from a Committee of the London Chamber of Commerce, not from the *Evening Standard*. It is part of our duty to acquaint our readers with public statements which are of vital importance to their interests, and to enable them to refute inaccuracies; and we are glad to know that British manufacturers are so well equipped to cope with the demand for battery carbons.—Eds. Elec. Rev.]

Keeping in Touch with Consumers.

In your issue of the 14th inst. an article on "Increased Revenue from Small Consumers" appears under the *nom de plume* of "Interested," in which the writer refers to the want of interest which is too often shown by electricity supply undertakings in their consumers when once they have been connected to their mains. We think, however, we can claim that this stigma does not apply to this company.

We have for some time past recognised the necessity of "introducing" ourselves to our new customers, and after allowing them three or four weeks in which to settle down, we send them a suitable letter of inquiry trusting the supply is giving them every satisfaction, reminding them of the possiblities of electricity for heating and cooking purposes as well as for lighting, and suggesting that our representative would call if desired.

We have found that this inquiry frequently brings a response, often leading to further business, and we cannot but feel that it has the effect of creating the impression in the mind of the new consumer that his interests are to some extent at least the concern of the supply authority.

E. G. Nicholson,
Secretary,
Woking. *The Woking Electric Supply Co., Ltd.*
October 18th, 1921.

[Many letters, received too late, are unavoidably deferred to a later issue.—Eds. Elec. Rev.]

BUSINESS NOTES.

Bankruptcy Proceedings.—Ernest Edward Mathers, 10c, High Street, Doncaster, Yorkshire, electrical engineer.—The public examination of this debtor was held on October 20th at the County Court Hall, Bank Street, Sheffield. The ranking liabilities were returned at £582, while the assets were estimated to realise £84. Debtor stated that he started business in April, 1921, with £150 capital, borrowed from his mother. He had never been successful. The examination was closed. The following are creditors:—

	£		£
Bassett Murray	12	Rickard, Wright & Dean... ...	15
Mrs. Sarah Ann Mathers	50	Scattergood & Johnson	35
Mrs. Sarah Ann Mathers... ...	150	Samuel Whitaker	118
Mrs. Sarah Ann Mathers... ...	150		

M. Watkinson, H. Watkinson, and A. Watkinson, trading as Watt & Co., 22 and 24, Palmer Road, Sheffield, electrical engineers.—The public examination of this debtor was held recently at the County Court Hall, Bank Street, Sheffield. The liabilities were returned at £870, while the assets amounted to £330. It appeared that the debtor Harold Watkinson commenced the business with between £40 and £50 capital in August, 1917, and was joined by his father, Matthew, and his brother Arthur a few weeks afterwards. They were successful until last year, but subsequently trade had been bad, and a number of orders had been cancelled since March last. The failure was attributed to defective material and insufficient capital.

Charles Philip Manners Downie, trading as and described in the receiving order as Philip Downie, 355a, Westborough Road, and 88, Ronald Park Avenue, Southend-on-Sea, Essex, electrical engineer and factor.—The application for discharge of this debtor was heard on October 17th at the Shire Hall, Chelmsford. The Deputy Official Receiver stated that a first and final dividend of about 4s. 9d. in the £ was expected to be paid on liabilities of £520. The receiving order had been made in May last. Debtor had traded in a small way at first, and then became associated with a company formed by his father, and he had been later pressed by the creditors of the company. The discharge was granted, subject to a suspension of two years.

W. Drysdale, electrician, 24, Paxton Street, Barrow-in-Furness.—Second dividend of 1s. in the £, payable at 4, Ranesden Square, Barrow.

Arthur Ernest Blower, electrical engineers' merchant, lately trading as "Blower & Cooper," 1, Paul's Bakehouse Court, Godliman Street, E.C.—The first meeting of creditors under this failure was held on October 25th before Mr. W. P. Bowyer, Senior Official Receiver, at the London Bankruptcy Court. The debtor, in his preliminary examination, stated that in September, 1917, Mr. Ashley Cooper joined him in the purchase of an electrical supplies business at the above address for £780, payable in instalments. They carried on the business in partnership successfully until December, 1920, when Mr. Cooper, being unable to devote his whole time to it, retired from the partnership. A balance of £400 was then owing in respect of the purchase money. The debtor continued the business alone until last August, when he closed down in consequence of the general depression and bad trade. He further stated that the partnership assets, which he held as trustee for the partnership, had depreciated in value, and he doubted whether they would realise more than £120, and as against that, £300 was still due to the vendor of the business. He returned his personal debts at £345, and valued his separate assets at £102. The estate was left with the Official Receiver to be wound up in bankruptcy.

Trade Announcements.—Mr. Owen A. Whittaker has commenced a maintenance and contracting business at 1, King's Walk Chambers, Parliament Street, Nottingham, and he desires to receive copies of manufacturers' catalogues. He will continue to be responsible for the maintenance of the plants of the printing and newspaper firms for which he has been chief electrical engineer for the past ten years.

The Salcombe Motor & Engineering Co., Ltd., has opened a branch of its electrical department in Rock Road, Torquay, with Mr. W. Lawrence as manager.

Mr. John Russ has removed from Stoke Newington to 22, and 23, Verulam Street, Gray's Inn Road, Holborn, E.C.

Messrs. Simplex Conduits, Ltd., announce an alteration of the address of their branch at Newcastle-on-Tyne. This was recently at 61-65, High Bridge, but these premises have been closed, and the business is now being carried on at 72, St. Mary's Place, under the same management (Mr. A. G. Robson). The telephone number and telegraphic address are as before (Central 2615 and "Simplex, Newcastle-on-Tyne").

Company Liquidations.—The T.B.S. Electrical Construction Co., Ltd., 68, Victoria Street, Westminster, London, S.W.—In pursuance of the provisions of the Companies (Consolidation) Act, a meeting of the creditors of this company was held on October 20th, at Winchester House, London, E.C. The chair was occupied by Mr. F. Clifford Goodman, C.A., who had been appointed to act as the liquidator in the voluntary liquidation of the company.

The Chairman said that all connected with the company regretted the position which had arisen. The company had been struggling against adversity for some little time, and recently a conference of the creditors was held at the Charing Cross Hotel. The creditors then decided to hold their hands for a period of six months in the hope that the company would turn the corner. The trading, however, had not improved, and as a result some three weeks previously the shareholders passed the usual resolution in favour of voluntary liquidation. Proceeding, the Chairman submitted a statement of affairs, which disclosed liabilities to the trade of £1,595, while there was a sum of £2,494 owing to the bank. The assets were set down at £1,289, and comprised book debts, £79; stock, machinery and fittings, £925; and furniture, £285. In addition, there was stationery, &c., valued at £62, but under a liquidation it would not realise anything. He was afraid that all the book debts were not good, while a claim which the company had to the extent of £474 was regarded as bad. No value had been placed on the goodwill, although something might be obtained if the business could be sold as a going concern.

In answer to a question, the Chairman stated that the bank held a guarantee from one of the directors of the company. The latter was registered in August, 1919, with a capital of £1,000, subsequently increased to £20,000. With regard to the trading of the company during the 13 months to September 30th last, the sales amounted to £8,806, with a gross profit of £2,573, but after paying all the expenses, there was a net loss of £2,457. The purchases during the 13 months totalled £5,597.

In the course of the discussion which ensued it was stated that the present position of the company had been brought about by the state of trade. The liquidator said he intended to advertise the business as a going concern in the trade Press. The landlord of the premises had held his hand, and not distrained. If a suitable tenant was found there would be no difficulty in sub-letting the premises.

A suggestion was made that the creditors should be represented in the liquidation, but eventually it was decided to confirm the appointment of Mr. Goodman as the liquidator of the company, and an informal committee was appointed consisting of the representatives of Messrs. Siemens Bros., Ltd., the English Electric and Siemens Supplies, Ltd., and the *Mark Lane Express*. The following are creditors:—

	£		£
The Alliance Electrical Co. ...	10	*Mark Lane Express*	125
Potter Bros.	45	*The Field* Press	66
B.E. Transformer Co.	13	*Our Homes and Gardens*	21
Journal of the Land Agents' Society	20	D.P. Battery	50
Scholey & Co., Ltd.	38	Crow, Toogood & Co.	20
Edison Swan Electric Co. ...	45	F. W. Berk & Co.	23
English Electric & Siemens Supplies, Ltd.	171	*Journal* of the Ministry of Agriculture	36
B.T.H. Co., Ltd.	19	Venner Time Switches	23
Siemens Bros.	353	J. & W. B. Smith	25
Electrical Review	30	De Martins Accumulators ...	88
A. C. Cossor, Ltd.	11	Huttons	11
Odhams, Ltd.	52	F. S. Bennett	154
		W. Norris & Co.	34

Messrs. Hall Bros. (Manchester), Ltd.—Liquidation resolved upon on August 5th. Receiver and liquidator: Mr. J. R. Atkins, 14, St. Ann's Square, Manchester.

Phonopore Construction Co., Ltd.—A petition for winding up has been presented to the Berkshire County Court by Mr. T. C. Cox, and will be heard at Windsor on November 10th.

Ampere Electrical Engineering & Plating Co., Ltd.—Meeting at the offices of Messrs. Eales & Hammond, North-Eastern Bank Chambers, Fowler Street, South Shields, on November 30th, to hear an account of the winding-up from the liquidator, Mr. T. L. Hammond.

Selson Engineering Co. (France), Ltd.—Meeting of members November 24th at 85, Queen Victoria Street, E.C., to hear an account of the winding-up from the liquidator.

Catalogues and Lists.—Messrs. Falk, Stadelmann & Co., Ltd., 83, 85 and 87, Farringdon Road, E.C. 1.—Catalogue No. 467, a fully priced and illustrated list of "Efesca" lanterns for gasfilled and vacuum tungsten lamps, brackets, electric signs, cast-iron lamp columns, and reflectors.

Mr. Harry Moss, 82, Leeds Road, Bradford.—An illustrated pamphlet giving prices of "Cosmos" fires, irons, and kettles.

Messrs. E. W. Farrow & Sons, 37, Berners Street, W. 1.—An illustrated booklet describing 50-kW "Aster-Siemens" generating sets with voltages ranging from 20 to 550 d.c. and a.c. (50 cycles, 3 phase).

Messrs. John Jardine, Ltd., Deering Street, Nottingham.—A large well-illustrated and priced catalogue of power transmission appliances, as bearings, pulleys, Plummer blocks, couplings, clutches, brackets and stands. Fully priced.

The "Zotozell" Fire Co., 11, Strand Street, Liverpool.—A card advertising some new electric fires.

Messrs. John Phillips & Co., 166, Walworth Road, S.E.17.—A pamphlet illustrating three commutator grinders—pillar type and friction driven.

Automatic Machinery Co., 28, New Union Street, Ancoats, Manchester.—An illustrated leaflet dealing with the "Rightway" 10-ton pulley drawer. Priced.

The Wholesale Fittings Co., Ltd., 23, 25, and 27, Commercial Street, E.C. 1.—Supplement No. E 103, an illustrated price list of pocket lamps, torches, dry batteries, accumulators, bells, &c.

The Falkirk Iron Co., Ltd., Falkirk, N.B.—Leaflet No. 264, describing the "Falco" electric cooker. Catalogue No. 268, giving illustrations and details of "Falco" electric fires and heaters. Both publications are priced.

The Melvin Engineering Co., Ltd., 5, Old Compton Street, W.1.—A leaflet setting forth the advantages of "Alubon" aluminium solder.

Kohler Co., Kohler (Wis.), U.S.A.—An illustrated booklet describing the "Kohler" automatic 1½-kW power and lighting set.

Materiel Electrique Alex Lefebvre, 9, Rue Arsène Houssaye, Paris.—A price list of generating plant, motors, transformers, and prime movers for sale.

The British Thomson-Houston Co., Ltd., 77, Upper Thames Street, E.C.4.—Leaflet L 209, illustrating and describing a colour attachment for use with "X-ray" reflectors. Priced.

Messrs. Spencer-Bonecourt, Ltd., Parliament Mansions, Victoria Street, S.W.1.—"Modern Steam Generation," a catalogue of numerous types of patent water-tube vertical boilers of standard, "squat," launch, and high-duty patterns. Several illustrations of these boilers and their applications are included, and the use of waste heat is dealt with.

Messrs. Bruntons, Wire Mills, Musselburgh, Scotland.—Illustrated booklet fully describing Prof. Haigh's high alternating stress testing machine, and including instructions for operating it.

Attracting the Consumer.—As part of its "campaign" for educating the public in electrical matters, the General Electric Co., Ltd., has issued a booklet in which the advantages of the use of electrical heating and cooking apparatus in the home are attractively set forth. While its direct object is to popularise "Magnet" appliances, the booklet will no doubt benefit the industry in general. An excellent idea of the company's has been to leave the inner cover blank and to offer to print particulars of local electricity supplies and charges on it free of charge.

The Electric Lamp Manufacturers' Association concerns itself not only with the efficiency and reliability of lamps and the stabilisation of prices, it acts also as a direct stimulus to the spread of electric lighting. The publicity work undertaken by individual lamp firms has an indirect effect upon the general popularity of electric lighting, and its success led the Association to attempt, two years ago, to supplement it by a combined effort to set forth, not the advantages of any particular lamp, but the broad advantages of electric light and of the lamps which bear the hall-mark of the Association. The results were so far promising, that the Association has arranged for another national publicity campaign during the season upon which we have now entered. This campaign has two phases. One is to arrest the attention of the world and his wife, and to create a livelier demand for electric light and E.L.M.A. lamps in the home, the office, the factory, and the public building. The second is to invite the active co-operation of the electrical trade. In pursuit of the first phase the newspaper and general Press is being utilised; and for the second phase the trade and technical journals form the first line of approach. Series of advertisements have been arranged in London daily and evening papers, and in provincial daily and weekly newspapers and in the specialist Press. The type of advertisement will, of course, be adapted to the class of user reached by each medium of publicity. A campaign on such an extensive scale should lead to a material increase in the demand for E.L.M.A. lamps, and doubtless the wholesale and retail electrical trade will be ready to satisfy that demand immediately it arises. Increased sales of lamps should also bring an augmented demand for reflectors and fittings, for numerous accessories, and for installation work in general.

Manufacturers' Conference.—It is announced in the daily Press that the National Union of Manufacturers will hold a conference on Tuesday afternoon, November 1st, at the Cutlers' Hall, Sheffield, Mr. George Terrell, M.P., presiding.

Lead.—Messrs. James Forster & Co. report (October 22nd):—"The position is decidedly interesting. Germany has lately bought a large quantity of lead, which has diverted much of our supplies both from Spain and from Burma. With the mark at over 600 to the £, it is difficult to believe that she is buying this lead for export in sheets, pipe and cables, as one authority asserts. Is it due to premature fears of the result of the Silesian settlement? Fears which may have no foundation, in fact, as the published details rather suggests. The result is short arrivals here and a run on warehouse lead, the stocks of which have been greatly depleted. Short supplies seem to be assured for the time being, but, on the other hand, there is no improvement in the position here—neither the domestic nor the electrical trades are better, indeed we hear of consumers with stocked warehouses of both sheet and pipe unsold who are still manufacturing to keep their men employed."

Copper and Lead Prices.—Messrs. F. Smith & Co. report (October 26th): Copper (electrolytic) bars £74 10s., 10s. decrease; ditto sheets, no change; ditto wire rods, £90 10s., 10s. decrease; ditto H.C. wire, 10 15/16d., 1/16d. decrease.

Messrs. James & Shakespeare report (October 26th): Copper bars (best selected), sheet, and rod, £101, £2 decrease; English pig lead, £25, 5s. increase.

Patent Applications.—Application has been made for the restoration of patent No. 12,709 of1912 for "Improvements in telegraphic photography" granted to Curt Stille.

A petition for the extension of the term of patent No. 6,224 of 1906 for "Improvements in alternating-current dynamo-electric machines," and patent No. 15,711 of 1906 for "Improvements in windings for alternating-current dynamo-electric machines," both granted to Louis John Hunt and The Sandycroft Foundry Co., Ltd., will be heard by Mr. Justice Sargant in the High Court on December 14th.

Cable Requirements and Unemployment.—The National Joint Industrial Council for the Cable Making Industry has issued a circular letter to municipal electricity committees pointing out that the lack of orders has caused serious unemployment in the industry. It is requested, therefore, that future extensions shall be considered immediately and orders placed, instead of being held over until the extensions become urgent.

Duty-Free Imports in Brazil.—The Norwegian Legation at Rio de Janeiro reports that Brazil has exempted from import duties machinery and plant for the production of hydro-electric power, electric locomotives, electric automobiles, electric motors, electric machinery and parts thereof, including those for sub-stations for the transmission of power and material for the transmission and distribution of power. The same concessions will be made for plant for steam generating stations using coal or fuel oil of national origin.

The Export Trade Facilities Bill.—The Trade Facilities Bill, introduced in the House of Commons last week by the Prime Minister, is described as a Bill to authorise the Treasury to guarantee the payment of loans to be applied towards the carrying out of capital undertakings, or in the purchase of articles manufactured in the United Kingdom required for the purposes of any such undertakings, and to amend the Overseas Trade (Credits and Insurance) Act, 1920, and the Overseas Trade (Credits and Insurance) Amendment Act, 1921. It provides as follows (among other things):—

"If the Treasury are satisfied that the proceeds of any loan proposed to be raised, whether within or without the United Kingdom, by any Government, any public authority, or any corporation or other body of persons, are to be applied towards or in connection with the carrying out of any capital undertaking, or in, or in connection with, the purchase of articles manufactured in the United Kingdom required for the purposes of any such undertaking, and that the application of the loan in the manner proposed is calculated to promote employment in the United Kingdom, the Treasury may, subject to the provisions of this section, guarantee in such manner and form and on such terms and conditions as they think proper the payment of the interest and principal of the loan or of either interest or principal—provided that the aggregate capital amount of the loans, the principal or interest of which is guaranteed under this section, shall not exceed the sum of £25,000,000."

No guarantee will be given by the Treasury under this section after the expiration of 12 months from the commencement of the Act.

A Local Exhibition.—Another local exhibition of domestic electrical appliances, of the kind which is doing a great deal to acquaint the public with the advantages of electricity, is being held at Harrow during the present week. It has been arranged at the Station Road Kinema by Messrs. Symper and Eversned, electrical contractors, with the co-operation of the General Electric Co., Ltd., and large crowds are being attracted to the show by means of extensive local advertising.

The usual range of domestic apparatus is present, and in addition there are several more spectacular devices without which no popular electrical display would be complete. Among these are a representation of a burning building "worked" by means of a screen revolving round an electric lamp. There are one or two colour changing signs on the same principle, and interest is also attracted by a small portable X-ray set which is used to send a long arc between a pair of electrodes. The centre of the hall is occupied by a large stand upon which are arranged irons, bowl fires, kettles, pocket lamps, lighting fittings, &c., as well as samples of telephone sets. One side of the building is taken up by representations of furnished rooms. A local firm has furnished these, and the G.E.C. has supplied the electrical fittings and appliances.

In the entrance hall demonstrations are being given of a "Time-Saver" washing machine, and in a corridor are numerous lighting fittings, shades, bowls, &c. By arrangement with the proprietors of an adjacent kinema, a film showing the manufacture of "Osram" lamps is being run concurrently with the exhibition. Refreshments are provided at an electric buffet, and an orchestra is present to enliven proceedings. Mr. J. W. Beauchamp has promised to deliver one or two lectures during the week.

Railway Electrification.—In the House of Commons on October 24th, Colonel Newman asked the President of the Board of Trade whether he was aware that the electrification of the suburban portions of the trunk lines leading out of London was urgently needed, but was hung up owing to the inability of the companies to raise the necessary capital; and would he say if a railway company would be eligible for a grant to carry out such work under the terms of the Trade Facilities Bill? Sir Robert Horne replied that the electrification was postponed, not because the companies could not raise the necessary capital, but because present prices rendered the work unremunerative. These schemes would come within the scope of the Trade Facilities Bill.—*Financier.*

Annual Social.—Members of the Blackpool Electricity and Tramway Employés' Institute held their annual social on October 20th, Mr. C. Furness, general manager, presiding. The Lumb Silver Cup for inter-departmental competition was won by the E. & T. team.

A Works Souvenir.—Messrs. A. Reyrolle & Co., Ltd., Hebburn-on-Tyne, have recently published an illustrated "Souvenir of a Visit to Hebburn." This contains some good illustrations of the firm's works and products.

For Sale.—Messrs. A. Goodman, Sons, Pollard & Braybrook are instructed by the liquidator to invite offers for the whole of the undertaking of the T.B.S. Electrical Co., Ltd. (in liquidation), including the right to use the name, certain concessionary rights, stock, &c.

Wigan Borough Council Electricity Department invites offers for four Willans & Robinson compound engines, coupled to G.E.C. generators, and three Belliss & Morcom triple expansion engines, coupled to Dick, Kerr generators.

Fuller, Horsey, Sons & Cassell will offer by auction on November 8th, at Edmonton, surplus plant and machinery including generating sets, motors, &c.

(For full particulars see our advertisement pages to-day.)

Tramwaymen's Wages Reduction.—In accordance with the agreement adopted by the Joint Industrial Council for a sliding scale based on the cost of living, tramway workers, nationally, from the first full pay period in November will have their wages reduced as follows: Employés aged 18 and over by a further 2s. per week, making a total reduction of 5s. per week; employés under 18 by a further 1s., making a total reduction of 2s. 6d. per week. These reductions, which are based on the latest index figure of 110, will apply to all tramway authorities who have given full effect to the decision of the Industrial Council regarding wages.—*Morning Post.*

Glasgow Hiring-out Scheme.—The Falkirk Iron Co., Ltd., informs us that the Glasgow Corporation has ordered over 100 "Falco" cookers for its apparatus hiring-out scheme; further orders are anticipated from this source.

The Engineers' Ballot.—A joint conference of the Unions affected by the engineering dispute is to be held in London to-day (Friday) to receive the result of the ballot. The question at issue is the withdrawal of the 12½ per cent. bonus. The employers have offered to effect the withdrawal in three stages—on November 1st, December 1st, and January 1st respectively. In the event of the terms being rejected, the men will be locked out from next Tuesday—November 1st. Present indications, however, are that the terms will be accepted. The voting in the North is said to show a considerable majority for acceptance, but a feature of the ballot is the large number of abstentions both in the engineering shops and in the shipyards.—*Morning Post.*

Birmingham Footballers.—Two of Mr. George Ellison's employes, Messrs. Smith and Spate, have been selected to represent the Birmingham and District Works Amateur Football Association in their match against the Victoria League on November 5th. Mr. Smith will captain the team.

Book Notices.—"The Choice of Motors for Industrial Work: Small Motor Applications," 54 pp. Trafford Park, Manchester: Metropolitan-Vickers Electrical Co., Ltd. (Special Publication 1550/2.)—This useful little handbook is designed for the use of those who, with little or no electrical training, contemplate the employment of motors in their establishments. As a preliminary the characteristics and construction of the several types of electric motor are described in sufficient detail. Diagrams explaining windings, and curves of performance are given for each type. Methods of computing the size of motor required are simply explained, and such points as mounting, speed, voltage, power factor, &c., are briefly dealt with. A number of applications of motors for various industrial purposes are illustrated.

"Statement respecting the Relation of Water Power to Canada's Fuel Problems," prepared by the Dominion Water Power Branch, Department of the Interior.—This publication has been prepared to show the necessity for the fullest use of water power in view of the high cost of coal and uncertainty of supplies. Statistics of outputs and fuel consumption in various countries reveal surprising inefficiencies, but it is gratifying to see that Great Britain appears in a comparatively favourable light in this respect. The financial saving effected by the use of hydro-electric power is illustrated by a number of concrete examples.

"General Physics and its Application to Industry and Everyday Life," by E. S. Ferry. Pp. xvi+732, figs. 591. London: Chapman & Hall, Ltd. Price 24s. net.

"Science Abstracts A. & B." Vol XXIV, Part 9. September 30th, 1921. London: E. & F. N. Spon, Ltd. Price 2s. 6d. each.

We have received the first part of Cassell's "Practical Metal Worker," which is to be completed in 24 fortnightly parts, published at 1s. net. The work, which is to be written by experts and well illustrated, will be a comprehensive guide to the working of metal.

"Blue Printing and Modern Plan Copying," by B. J. Hall. Pp. ix+130, figs. 62. Price 6s. net. "Factory Administration in Practice," by W. J. Hiscox. Pp. x + 211; 68 figs. Price 8s. 6d. net. London: Sir I. Pitman & Sons, Ltd.

"Finsbury Technical College and Old Students' Magazine," Vol. IV, No. 2, October, 1921. London: The College. Price 2s. 6d. (free to members).—Containing reports of meetings, and notes of interest to old students.

"*Journal* of the American Institute of Electrical Engineers," Vol. XL, No. 10, October, 1921. New York: The Institute. Price $1.

British Empire Rubber.—The Secretary of State for the Colonies has appointed a committee to report upon the present situation with regard to rubber in the British Empire. The committee is asked for suggestions for improving existing conditions. The chairman is Sir James Stevenson, Adviser to the Colonial Secretary, and among the members is the chairman of the Rubber Growers' Association, Sir Stanley Bois.

New Works in Canada.—The Eugene F. Phillips Electrical Co., Ltd., a large manufacturer of copper electric wire, announces that it will erect a plant at Brockville at a cost of $3,000,000, utilising 3,000 e.h.p., and employing 600 hands. The Semet Solvay Co. plans to erect a gas and coke oven plant at Hamilton next spring at a cost also of $3,000,000.—*Reuter's Trade Service.*

German Subterfuges.—Melbourne Customs officials declare that German manufacturers are unsuccessfully trying all sorts of subterfuges to circumvent the Customs and place goods on the Australian market.—*Financial Times.*

Porcelain Insulators in Finland.—The Arabia Porplins fabrik A.B., of Helsingfors, has just brought into operation plant for the testing of high-pressure insulators up to 300,000 volts.

Trade Conditions in South Africa.—The general managers of the Standard Bank of South Africa report that there is some improvement in the demand for electrical goods, and prices are unchanged. Mining material and machinery business is restricted and prices tend downward.—*Reuter's Trade Service* (Cape Town), October 24th.

Ability in Industry.—The fifth of the series of industrial lectures organised by the Industrial League and Council will be given at Caxton Hall, S.W.1, on Wednesday evening, November 2nd, at 7.30 p.m., when the lecturer will be Mr. E. C. de Segundo, A.M.I.C.E., who will speak on "Ability as a Factor in the Production of Wealth."

Machinery Import Exemptions in Ecuador.—The Government of Ecuador has passed a law exempting the import of all raw materials and machinery from duties and taxes in an effort to attract manufacturing enterprises and foreign capital.—*Reuter's Trade Service.*

Trade Revival?—The *Financial Times* quotes Mr. Hugo Hirst, managing director of the General Electric Co., Ltd., as saying that so far as the engineering trades were concerned he was of opinion that if only foreign buyers would take full advantage of the benefits under the Government credit scheme a considerable industrial revival might take place. The task of supplying material for such work as building new railways would give employment to large numbers and would result in the re-employment of many hands who were at present stood down.

Chinese Notes.—The electricity and waterworks in Haichow will be under the management of the Haichow municipal administration.

The Liyang Telephone Co., of Liyang, Kiangsu, proposes to install telephone wires as far as Nantu. The Ministry of Communications has given its approval.

The Ministry of Communications has registered the Chouchen Telephone Co., of Chouchen, Shantung.

It is reported that General Chen Chung-ming has decided to install wireless plants in Wuchow and Canton.

Lantern Slides.—Messrs. E. Bennis & Co., Ltd., have a large number of lantern slides of mechanical stokers and coal and ash elevating and conveying plant available for lecture purposes. Those interested can obtain a booklet giving particulars from the company at 28, Victoria Street, London, S.W.1.

LIGHTING AND POWER NOTES.

Blackburn.—Opening of New Station.—The new generating station at Whitebirk (described in our last issue) was formally opened by Lord Derby on October 21st. It has cost the town £850,000, and Lord Derby expressed the opinion that the investment was a good one. Over 150 guests from all parts of the North were conveyed by special train from Blackburn to the new works at Whitebirk, where a tour of inspection was made, in the course of which Lord Derby started the first set. His lordship was presented with a silver casket, appropriately inscribed, from the contractors, in commemoration of the event, the gift being presented by Sir Charles Ellis, chairman of the English Electric Co. Among those present were Mr. P. P. Wheelwright, the borough electrical engineer, to whose design the construction of the works was carried out; Sir Charles Ellis, G.B.E., K.C.B., and Mr. P. J. Pybus, managing director, representing the English Electric Co. Mr. J. Meadowcroft, J.P., said that when completed the station would be one of the largest and most efficient in the country, and would be a lasting credit to the town, and particularly to the Electrical Engineer. Lord Derby said that Blackburn had set a good example. They had had the best of everything, and it would be the cheapest in the end.

The English Electric Co., Ltd., distributed a handsome souvenir booklet, to those present at the ceremony, embodying a description of the plant and a number of views of the station.

Bradford.—Year's Working.—An abstract of accounts for the year ended March 31st, 1921, and the annual report of the Electricity Committee of the City of Bradford electricity supply undertaking (of which Mr. Thomas Roles is engineer and manager) show that the output proved to be 55,683,518 kWh, the greatest recorded in the history of the department, being 6,387,451 kWh in excess of the output for the year ended March, 1920.

Bulk supply increased by 2,576,856 to 25,477,916 kWh; private lighting by 906,559 to 4,772,320 kWh; domestic supply by 520,639 to 1,717,608 kWh; power and heating by 687,746 to 10,394,792 kWh; public lighting by 5,057 to 117,393 kWh; and tramway supply by 1,690,594 to 13,203,480 kWh.

The income of the department from all sources for the year was £435,692, this sum being £106,459 more than for the preceding financial year. The working expenses totalled £331,972, an increase of £86,708. The gross profit amounted to £103,720; interest and sinking-fund charges absorbed £93,117, leaving a surplus on the year's working of £10,603, as compared with a deficit of £3,419 for the preceding twelve months.

The number of consumers increased by 1,283 to 7,712, and the b.h.p. of motors from 32,516 to 37,001. The capacity of the plant rose from 18,150 to 28,390 kW, and the cost was 1.779d. (including capital charges), and the average price obtained was 1.78d. per kWh sold.

The completion of certain items of extension which have been in progress for some time at the generating station is recorded; the first of the 12,000 kW turbo-alternators (No. 5) was put into commission in September, 1920, and has since been in practically continuous service with highly satisfactory results, not only as regards its operation, but from the point of view of coal economy. The erection of the second 12,000-kW turbo-alternator is now practically finished, and it is hoped that the plant will be in service in time to assist in carrying the coming winter's load.

A third turbo-alternator of about 12,000 or 15,000 kW rating will eventually be installed, and an order was placed last October with Messrs. Babcock & Wilcox, Ltd., for a new boiler house and equipment. The contract comprises, in addition to the buildings, four water-tube boilers of marine type of large size, complete with superheaters, travelling grate stokers, and economisers, feed pumps, coal-handling plant, and piping system. The design of this boiler house incorporates the very latest features in connection with boiler-house practice; it is not anticipated that the work will be completed before the summer of next year, but the department is not likely to be inconvenienced to any great extent by this delay. The e.h.p. switchgear at the Valley Road works is in course of extension to provide for the control of additional feeders to different parts of the City. The new gear is of the totally-enclosed ironclad type manufactured by Messrs. A. Reyrolle & Co., Ltd.

Electricity Supply Extensions.—The Electricity Committee has decided to supply electricity to the Idle and Thackley districts at an estimated cost of £21,800, and to Clayton, particulars of which are not yet to hand. The object of the scheme is to provide work for the unemployed.

Brierfield.—Increased Charges.—The Urban District Council has decided to increase the charges for electricity by ¼d. per unit for lighting and ¼d. per unit for power, to date from the September quarter.

Canada.—Toronto.—The report of the Toronto Electric Commissioners upon their department for the year ended December 31st last shows that the total receipts amounted to $3,150,847, an increase of 25.8 per cent. The cost of the bulk supply from the Hydro-Electric Power Commission of Ontario, was $974,828, and operating costs, depreciation, improvement charges, &c., $988,748, making a total expenditure of $1,963,576. Of the gross balance, $1,187,270, capital charges absorbed $1,064,543, leaving a net balance of $122,727. The general manager (Mr. H. H. Couzens) states that the connected load increased by over 18,500 h.p. and the energy consumption by over 34,000,000 kWh.

China.—Electrical Undertakings.—Subscriptions have been raised in Weihsien and Fengtze (Shantung) for the purpose of installing an electric supply in these districts. Land has been purchased, premises erected, and machinery ordered from abroad.

The Yungting Hydro-Electric Co., organised by Yu Yuetang, recently petitioned the Ministry of Agriculture and Commerce and the Ministry of Communications for registration.

Derry.—Reduced Charges.—The Corporation has decided to reduce the charges for electricity by 25 per cent., on the basic rate for long-hour lighting, and 18 per cent. for short-hour lighting.

Emsworth.—Electricity Supply.—Steps are being taken to provide the district with electricity, and negotiations have been opened with the Portsmouth Corporation for laying the cables and distributing electricity.

Electricity District.—South-East Lancashire.—We have received very full details of the scheme for the reorganisation of the supply of electricity in the above-named area which has been submitted to the Electricity Commissioners on behalf of the local authorities and companies that are supporting the scheme. We hope to outline the scheme in our next issue. Copies of the scheme, at the price of 5s. each, are obtainable from Mr. A. H. Banks, secretary *pro tem.*, Town Hall, Manchester.

Faversham.—Loan.—The Town Council has applied for sanction to borrow £1,000 to meet the cost of a Petter oil plant installed at the electricity works.

Hornsey.—Extensions.—£20,000 is to be spent on electricity undertaking developments.

Huddersfield.—Loan.—The Electricity Committee is applying to the Electricity Commissioners for sanction to the borrowing of £100,000 for mains extensions, &c.

Leominster.—Maximum Charges.—The Rural District Council has consented to the following charges being inserted in the Order applied for by the Hereford Town Council for the rural area: Quarters ending March 31st and December 31st, any amount up to 15 units, 17s. 6d., and 1s. 2d. per unit over 15; quarters ending June 30th and September 30th, up to 10 units, 11s. 8d., and 1s. 2d. per unit over 10.

Llandrindod Wells.—Price Revision.—The Ministry of Transport has made an Order empowering the Electric Light Co. to charge for a period of ten years a maximum of 1s. 2d. per unit, with a minimum charge for the winter quarters for 10 units or less.

Londonderry.—Proposed Price Reduction.—Having regard to the satisfactory position of the electricity undertaking, the Corporation electrical engineer recommends that when the shipyard tariff is brought into line with the charges to other consumers a general reduction should be made. In some cases the proposed reduction will amount to as much as 37 per cent.

Oldham.—Loan.—The Electricity Committee has decided to apply to the Electricity Commissioners for additional borrowing powers to cover an over-expenditure of £6,382. The total expenditure on mains up to March, 1920, and during the year 1920-21 was £60,482.

Rugby.—Municipal Trading Protest.—The Local Building Trades Employers' Association has written to the Urban Council complaining that the electricity department competes with contractors for the installation of lighting systems and plant on private property, which it is contended is illegal. The matter has been referred to the Electricity Committee, and the Association has been asked to particularise cases of alleged municipal trading.

Salford.—New Station.—The Electricity Committee reports that the scheme for the erection of a new power station at Agecroft is not yet ready for submission, but it recommends the expenditure of a further £10,000 upon the preparation of the site, as a means of absorbing unemployed labour.

Stoke-on-Trent.—Loan.—The Electricity Committee has applied to the Electricity Commissioners for sanction to borrow £20,000 for mains extensions and £10,000 for transformers, switchgear, and equipment, to be expended within the next two or three years.

Skegness.—Electric Light Scheme Abandoned.—The Town Council has decided not to take any further steps in the matter of providing electricity for the town. According to Mr. C. H. Wordingham, an effective scheme would cost £40,000, and as the town's outstanding debt is already £102,000, it was considered inadvisable to proceed further.

Southport.—Price Reduction.—The Electricity Committee has decided to reduce the charges for electricity by 25 per cent. This is the outcome of the installation of new plant, by which a saving of 30 per cent. will be effected in the consumption of coal.

South Shields.—New Plant.—On October 19th a new generating set was started up at the Corporation electricity works. This consists of a Metropolitan-Vickers 3,000 r.p.m. impulse turbine direct coupled to a 3,000-kW, 3-phase, 50-cycle, 2,250-V generator with exciter mounted on an extension of the main shaft. The air and extraction pumps are driven by a 26-h.p., 550-V, d.c. motor running at 1,440 r.p.m. The condenser water is circulated by a 90-h.p. variable-speed motor coupled to a centrifugal pump capable of dealing with 192,000 gallons per hour.

A 1,000-kW, 6-phase rotary converter has been installed, which will convert the supply to d.c. at from 500 to 550 V for traction purposes. In conjunction with this a 1,100-kVA transformer has been installed. The circulating water culverts are designed to deal with 1,250,000 gallons per hour, and about 290 tons of concrete was used in their construction.

Swansea.—Counteracting Extravagance.—The Council has approved a recommendation of the Electricity Committee that the weekly payment for electricity used in the Corporation workmen's dwellings should be increased from 1s. to 1s. 6d., that meters be installed, that the Corporation should pay for the initial cost of lamps only, and that any consumer using more than 100 units per annum should pay the ordinary rates. The reason given for the recommendations was that the consumers were not using electricity economically.

Teignmouth.—Electricity Supply Scheme.—A meeting was recently held to explain the electricity supply proposals and the formation of a company was decided upon. A small committee was formed to take the necessary steps.

Ystradgynlais.—Purchase of Undertaking.—The Urban District Council has decided to purchase the Glantawe electric supply works at a cost of £18,000, and application has been made to the Electricity Commissioners for a Provisional Order.

TRAMWAY AND RAILWAY NOTES.

Bradford.—Track Renewals.—In order to provide work for the unemployed, the Tramway Committee has decided to re-lay the Eccleshill line from Idle road to the terminus, at an estimated cost of £16,623, and the Wyke tramway near Odsal Top, at a cost of £9,523.

Edinburgh.—Reduced Fares.—The Council has decided to introduce lower fares on the various tramway routes in the city. The new fares are expected to be in operation within a few days.

Track Renewal.—A portion of the Portobello track is to be renewed at a cost of £54,000, in order to provide work for the unemployed.

Halifax.—Tramway Improvements.—The Tramway Committee proposes to construct an additional loop near the Cavendish Hotel, between Catherine Slack and Ambler Thorn, at a cost of £1,000.

Huddersfield.—Tramway Extensions.—The Town Council has decided to proceed with the construction of a portion of the new tramway route to Brighouse. It is estimated that the scheme will provide work for 400 men.

London.—Proposed "Underground" Extensions.—According to the *Daily Mail*, extensions involving the expenditure of about £8,000,000 are contemplated by the Underground Railway Companies. The proposals include the reconstruction of the City and South London Railway, the building of a surface line from Golder's Green to Edgware, and one or two linking-up schemes.

Tramway Extension.—The London County Council tramway Service 35 has been extended along the whole length of Holloway Road, terminating at Highgate.

Middlesbrough.—New Track.—A double tramway track is to be laid along Stockton road from the Middlesbrough boundary to the old river bridge, at an estimated cost of £19,500.

Newcastle.—Unemployment Relief.—Discussing measures for relieving unemployment in the district, the chairman of the Transport and Electricity Committee stated recently that it was expected that the rails for the Barras Bridge-Gateshead extension would be delivered in the course of a month. The Committee had been given to understand that the Gosforth Light Railway Order had been approved, and it had been decided, therefore, to proceed with the work in anticipation of the receipt of the Order.

The preliminary work in connection with the extension of the Byker car sheds was also to be commenced forthwith.

Salford.—Year's Working.—The report of the general manager of the Corporation tramways (Mr. G. W. Holford) for the year ended March 31st, 1921, records receipts amounting to £542,747, as against £495,025 in the previous year. Working expenditure amounted to £426,284, as compared with £375,497, leaving a gross profit of £116,463 (£119,528). The payment of all capital charges left a net profit of £17,038, a considerable decline from the profit of £37,610 made in the preceding year, when £20,000 was contributed towards rate relief. The number of passengers carried fell from 80,587,359 to 78,142,501, although there was an increase in the car miles run from 5,961,197 to 6,019,067.

South Shields.—Year's Working.—The total revenue of the tramway department for the past financial year was £102,086, as compared with £76,301 in 1919-20. Working expenses amounted to £98,708, as against £71,224, leaving a gross profit of £3,378 (£5,077). After the payment of capital charges, the net result was a profit of £549. The surplus was due to increased fares put into force during the year, a debit balance of nearly £6,000 having been anticipated prior to the increases. The charge for power was increased from 1¼d. to 2¼d. per kWh. There was a loss on the omnibus services.

United States.—New Electric Railway.—The Dallas Railway Co., of Dallas, Tex., is completing plans for the construction of an addition to its interurban railroad system from Dallas to Terrell, Tex., a distance of about 30 miles, estimated to cost $1,800,000, including rails, line equipment, electric stations, electrical and mechanical apparatus. Nearly all of the right-of-way has been obtained and orders for materials are being placed.

The city of Rochester, N.Y., is planning to build a fourteen mile rapid transit and industrial electric railway in the abandoned bed of the Erie canal. The cost of the project is to exceed $4,000,000.—*Railway Review.*

TELEGRAPH AND TELEPHONE NOTES.

Australia.—Long-range Wireless.—In his address at the annual meeting of shareholders in Amalgamated Wireless (Australasia), Ltd., Sir Thomas Hughes, chairman of the directorate, reminded his hearers that the company had placed before the Federal Government an offer to provide a direct commercial wireless service between Australia and England, and to extend that service locally so that each State would

derive equal advantages from it. That offer, he said, had been favourably considered by the Federal Government, but owing to the English scheme the Federal Government did not proceed with the company's. They had learned since that there was considerable doubt whether the English scheme would ever be completed because there were so many objections to it. From the Australian point of view, continued Sir Thomas Hughes, the scheme appeared to be quite unsuitable because every message between Australia and England would have to pass over a chain of five stations, which introduced five points of weakness, and adding to the expense. The cost of every message would have to be divided among five stations. The committee itself had estimated that Australia would lose a large sum per annum on this scheme. He understood that neither the British Admiralty, the War Office, nor the Air Ministry had been consulted in reference to that committee and its scheme, and furthermore, it was a fact that the committee was formed, and made its report without reference to any of the Dominions. He claimed that the experimental work which the company had done in Australia during the past few years had proved beyond a doubt that it was possible to have direct wireless communication between Australia and any other part of the world, and that the only logical application of such knowledge was to erect a high power main overseas station, with local or feeder stations at each capital, to work directly with the main trunk station. Such a scheme the company was prepared to carry out, and to finance, either entirely on its own account, or in conjunction with the Federal Government. The company was in a position to supply one of the greatest needs Australia had ever felt, and to offer reasonable prospects of a good return on the capital needed for the purpose. Furthermore, the company hoped to be able to conduct the services at reduced rates.

Belgium.—Wireless Train Control.—The Belgian Nord Railway Co. is experimenting with a new signal system by which the chief of the train service organisation communicates with the signal cabins by wireless telephone.—*The Times.*

Night Telegraph Service.—The Newspaper Conference, representing the Press of the United Kingdom outside London, has adopted the subjoined resolution: "That in the view of the Newspaper Conference the strongest protest should be made in the public interest against what is obviously the policy of the Post Office to cease the all-night telegraph service in various provincial towns. The conference is of opinion that this restriction, or the attempt to exact a special payment to prevent it, is contrary to the spirit of the Post Office administration—that the service should be regarded as a whole. The conference directs attention to this matter lest undisputed acceptance of the present official scheme may be treated as a precedent to be applied to other provincial towns."—*Daily Telegraph.*

Russia.—New Radio Station.—In Moscow, on September 25th, the foundation stone of the principal building of the trans-Atlantic wireless station was laid. The station will be of 500 kW, and it will be able to communicate with all the radio stations in the world. It will be built by Russian engineers, following and using all inventions and improvements by Russian engineers. All the equipment will be prepared exclusively in Russian factories. It is intended to put the station to work next year, says a Moscow message to a North Russian journal.

The Toll Telephone Exchange.—When the "Toll" telephone exchange was opened by the Postmaster-General in London on September 17th last, Mr. Kellaway pointed out that its chief advantage, apart from the very substantial benefit of affording relief to the London "Trunk" exchange, which was being taxed to the limit of its capacity, was that in most cases it might be possible to secure connections to the provincial towns served by the exchange on demand. The records which have been taken since show that only about 5 per cent. of the total calls made throughout the day in London fail to secure immediate connection and have to be booked for completion later. The average number of outgoing calls is 5,000 daily, and the incoming traffic reaches about 6,000 calls per day.

Experience has already shown that some of the towns included in the "Toll" area require even greater facilities than were provided by the original disposition of the circuits, and steps are being taken to provide them.

Some 500 calls are still being passed daily by telephone users to "Trunks," whereas the wanted numbers are within the "Toll" area. It will add to the success of the "Toll" service if subscribers will, before applying for calls to places outside the London local area, ascertain whether "Trunks" or "Toll" should be asked for.

Wireless Telegraphy.—Facsimile Reproduction.—The *New York World* on October 18th published facsimile reproductions of messages in the handwriting of M. Briand and General Pershing, transmitted from Paris by wireless to America. The achievement is a step in advance of the work of Edouard Belin, inventor of "telegraphic photography." M. Belin received the facsimile messages through the United States naval wireless station at Annapolis, and enthusiastically predicts that it will be only a short time before pictures will be wirelessed across the Atlantic as easily as they are now transmitted by cable.—*Daily Telegraph.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Melbourne.—Victorian Government Railways. January 4th. 159 electric train stops operated by a single-phase induction motor. One set of electrical pyrometer equipment for measuring temperatures of from 350 to 2,000 degrees Fahrenheit.—*Reuter's Trade Service* (Melbourne).

City Council. February 20th. One 2,000-kW rotary converter with transformer, also 6,600 V, 50-cycle, 3-phase switchgear.—*Reuter's Trade Service* (Melbourne).

Newcastle (N.S.W.).—December 22nd. City Council. One 25-kW motor-generator set. Electrical engineer and manager, Watt Street, Newcastle (N.S.W.).

Aylesbury.—November 11th. Town Council. Electric motors and pumps. (October 21st.)

Belgium.—November 14th. The Société du Canal et des Installations Maritimes de Bruxelles (59 Rue du Canal, Brussels). Electrically-operated pump capable of delivering 650 cubic metres of water per hour.

India.—Calcutta.—November 9th. Calcutta Electric Supply Corporation, Ltd. One 15,000-kW turbo-alternator and condensing plant. Two water-tube boilers with an evaporation of 60,000 lb. per hour. (October 7th.) Paper-insulated, lead-covered cables, bitumen-sheathed cables, v.i.r. cables, and joint boxes (Spec. 72). (October 21st.)

London.—L.C.C.—November 28th. Water-tube boilers, superheaters and economisers, &c. (October 21st.)

New Zealand.—Wellington.—November 21st. Post and Telegraph Department. 750 red and 750 white switchboard cords, 3 conductor. (Spec. No. 87.)*

Portsmouth.—November 18th. Corporation. Four centrifugal pumps, direct coupled to 3-phase, a.c. motors, sludge pump and motor, and various small motors, switchboard cables, lighting, and other apparatus. (October 21st.)

Sheffield.—November 26th. Health Committee. Plant and machinery for refuse disposal works, including cranes, switchboard, pumps, &c., steam-driven electrical plant and condensers, motors, and starters, &c. (See this issue.)

South Africa.—Johannesburg.—November 7th. Rand Water Board. Two 350-kW steam-driven electrical generating sets, complete with switchboards and all accessories.*

Durban.—Municipal Council. 250 single-pole, or 125 double-pole ironclad fuses, 25 amperes, 200 volts; 500 combined double-pole enclosed switches and fuses, 35 amperes, 200 volts, suitable for house service use; 144 single-pole switch fuses, unmounted, 100 amperes, 200 volts; 50 single-pole switch fuses, of the "Brush" or other similar type, 50 amperes, 2,750 volts, suitable for sub-station use. One 3-phase transformer, 25 kVA capacity, 50 cycles.*

Warrington.—November 15th. Electricity and Tramways Committee. Motors and transformers. (October 21st.)

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W.1.

CLOSED.

Belgium.—Fifteen firms—Belgian, German, Austrian, Swiss, Italian and British—competed for the contract to supply 16,500 metres of armoured cable of different sizes for the municipal authorities of Schaerbeek, Brussels. The lowest offer—337,707 fr.—was submitted by F. Lemoine, of Dison, Belgium.

Bradford.—Tramways Committee.

Fifteen tons of steel fishplates, at £285.—North-Eastern Steel Co.

Electricity Committee.

Soot blower installation for four boilers for No. 4 boiler house at Valley Road works.—Babcock & Wilcox, Ltd.

Glasgow.—Tramways Department. Recommended:—

Trolley wire.—Thomas Bolton & Sons, Ltd.
Three-way switches.—Edison Swan Electric Co., Ltd.

Corporation. Recommended:—

Three kinematograph operating machines complete, for £110 each, for Corporation halls.—Chalmers, Ltd.

Markets Committee. Accepted:—

Electric lighting installation at Cheese Market.—Grindley, Ross & Co., Ltd.

Electricity Committee. Recommended:—

Construction of No. 2 circulating water inlet at the Dalmarnock generating station.—John Train & Taylor, £17,386.
For providing screens for the inlet.—Brackett & Sons, £4,219

Government Contracts.—The following Government contracts were placed during September, 1921 :—

ADMIRALTY (CONTRACT AND PURCHASE DEPARTMENT.)

Accumulator cells.—Fuller's United Electric Works, Ltd.; London Battery and Cable Co., Ltd.
Lampholders.—Edison Swan Electric Co., Ltd.; General Electric Co., Ltd.; W. McGeoch & Co., Ltd.
Wireless telegraphy masts.—C. F. Elwell, Ltd.

WAR OFFICE.

Automatic dust control with motor.—J. M. Adam & Co.
Generating set spares.—A. Lyon & Co., Ltd.
Electric wires.—British Insulated & Helsby Cables, Ltd.

AIR MINISTRY.

Electrical equipment.—General Electric Co., Ltd.
Ignition sets.—British Thomson-Houston Co., Ltd.
Electrically-driven pumps.—Rees Roturbo Manufacturing Co., Ltd.
Switchboard.—Erskine Heap & Co., Ltd.

POST OFFICE.

Laying conduits.—Norwood Road and Palace Road: J. Mowlem & Co., Ltd. Lewisham (Loampit Hill): J. Mowlem & Co., Ltd. Limehouse (Three Colt Street): J. Mowlem & Co., Ltd. Hither Green: J. Mowlem & Co., Ltd. Kensington. Paddington, and St. Marylebone: J. Mowlem & Co., Ltd. Camberwell (Southampton Street): Roads and Public Works, Ltd. King's Cross (Albion Street): Roads & Public Works, Ltd. Brighton-Worthing (Section I): H. Farrow. Waltham Cross-Epping-Bishop's Stortford (Section III): H. Farrow. Edinburgh (E.) and Tranent: R. Thorburn & Son. Brockley: Greig & Matthews. Brighton-Roedean, &c.: Greig & Matthews. Waltham Cross-Epping-Bishop's Stortford (Section I): J. A. Ewart, Ltd. St. Pancras: J. A. Ewart, Ltd. Huddersfield-Halifax: E. E. Jeavons & Co., Ltd. Oldham-Huddersfield (Section II): W. Pollitt & Co., Ltd. Horbury: W. Pollitt & Co., Ltd. Upton: Martin & Element, Ltd. Stanmore-Chesham (Section II): W. & C. French. Stanmore-Chesham (Section I): W. & C. French. St. Helens: G. Percy Trentham, Ltd. Port Talbot: G. Percy Trentham, Ltd. Blackwood, Mon.: G. Percy Trentham, Ltd.
Manufacture, supply, drawing-in, and jointing cable.—Elizabeth Terrace-Widnes-Runcorn: W. T. Glover & Co., Ltd. Trafford Park, Manchester, Weybridge-Woking, &c.: W. T. Henley's Telegraph Works Co,, Ltd. Glasgow-Paisley: British Insulated & Helsby Cables, Ltd. Birmingham-Dudley-Tipton, Dudley-Stourbridge-Cradley Heath: Pirelli-General Cable Works, Ltd.
Telephone exchange equipment.—Chorlton-cum-Hardy: Automatic Telephone Manufacturing Co,, Ltd. Sub-contractors—for batteries: Chloride Electrical Storage Co., Ltd.; for charging machine: Crompton and Co., Ltd.
Telephone apparatus.—Phœnix Telephone & Electric Works, Ltd.; Siemens Bros. & Co., Ltd.
Testing, protective apparatus, &c.—Automatic Telephone Manufacturing Co., Ltd.; British Thomson-Houston Co., Ltd.; S. G. Leach & Co., Ltd.
Telegraph and telephone cable.—British Insulated & Helsby Cables, Ltd. Enfield Ediswan Cable Works, Ltd.; Pirelli-General Cable Works, Ltd.; Union Cable Co., Ltd.
Loading coils.—Western Electric Co., Ltd.
Ducts.—Albion Clay Co., Ltd.
Charging panels.—Power Equipment Co., Ltd.

CROWN AGENTS FOR THE COLONIES.

Accumulator Cells.—Tudor Accumulator Co., Ltd.
Control apparatus.—Western Electric Co., Ltd.
Motor-driven fan, &c.—Babcock & Wilcox, Ltd.
Generating set.—Norris, Henty & Gardners, Ltd.
Oil-cooled transformers.—Metropolitan-Vickers Electric Export Co., Ltd.
Wireless sets.—Marconi Wireless Telegraph Co., Ltd.

HIGH COMMISSIONER FOR INDIA.

Batteries.—Chloride Electrical Storage Co., Ltd.
Generating sets.—Laurence Scott & Co., Ltd.
Lamps.—British Thomson-Houston Co., Ltd.
Switchboards.—Peel-Conner Telephone Works, Ltd.
Telephones.—Peel-Conner Telephone Works, Ltd.
Telephone equipment.—Relay Automatic Telephone Manufacturing Co., Ltd.

H.M. OFFICE OF WORKS.

Engineering services.—Additional plant, National Physical Laboratory: Bruce Peebles & Co., Ltd.
Pontypridd housing scheme.—Electric wiring: D. G. Ball.

PUBLIC WORKS, DUBLIN.

Electrical works and supplies, Dublin.—Handley & Robinson, Ltd.

London.—HAMMERSMITH.—Electricity Committee. Recommended :—

Two 200-kW oil-cooled transformers, £494.—Hackbridge Electric Construction Co., Ltd.

STEPNEY.—Borough Council. Electricity Department. Accepted :—

Half mile 3-in. earthenware pipes, £135.—Sutton & Co.
One mile 3-in. earthenware pipes, £269.—Albion Clay Co., Ltd.

Manchester.—Education Committee. Accepted:—

Electric lamps.—Princess Manufacturing Co.

Swansea.—Town Council. Accepted:—

6,600-V switchgear, £185.—Metropolitan-Vickers Electrical Co., Ltd.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, October 28th. At the Institution, Storey's Gate, S.W. At 6 p.m. Discussion on Eleventh Alloys Report. Friday, November 4th. Thomas Hawksley Lecture on "Power Transmission by Oil," by Dr. H. S. Hele-Shaw, F.R.S.

Junior Institution of Engineers.—Friday, October 28th. At Caxton Hall, S.W. At 8 p.m. Paper on "Water Gas Manufacture," by Mr. F. Colin-Sutton.

Electrical Power Engineers' Association (Southern Division).—Saturday, October 29th. At the Hotel Cecil, Strand, W.C. At 5.30 for 6 p.m. Third annual dinner.

Bristol Association of Engineers.—Tuesday, November 1st. At the Royal Hotel. At 8 p.m. Address by the President, Prof. D. Robertson, on the "Centenary of the Continuous Current Machine."

Institution of Civil Engineers.—Tuesday, November 1st. At the Institution, Great George Street, S.W. At 6 p.m. Inaugural address by the President, Mr. W. B. Worthington.

Roentgen Society.—Tuesday, November 1st. At the Institution of Electrical Engineers, Victoria Embankment, W.C. 2. At 8.15 p.m. General meeting.

Royal Society of Arts.—Wednesday, November 2nd. At John Street, Adelphi, W.C. At 8 p.m. Address by the Chairman of the Council, Mr. A. A. Campbell-Swinton, F.R.S., on "Wireless Telegraphy."

Institution of Railway Signal Engineers.—Wednesday, November 2nd. At the Midland Grand Hotel, St. Pancras, N.W.1. At 6 p.m. Paper on "Three-position Signalling," by Mr. A. E. Tattersall.

"Dynamicables."—Wednesday, November 2nd. At the Engineers' Club. At 7.30 p.m. Dinner, Mr. J. S. Highfield in the chair.

Industrial League and Council.—Wednesday, November 2nd. At Caxton Hall, S.W.1. Lecture on "Ability as a Factor in the Production of Wealth," by Mr. E. C. de Segundo.

Societe des Ingenieurs Civils de France (British Section).—Wednesday, November 2nd. At the Institution of Mechanical Engineers, Storey's Gate, S.W. At 5.30 p.m. Paper on "The Efforts of France in the Reconstruction of the Devastated Regions," by the Marquis de Chasseloup-Laubat.

Institute of Cost and Works Accountants.—Wednesday, November 2nd. At the Hall of the Institute of Chartered Patent Agents. At 7 p.m. Lecture on "The Human Element in Keeping Costs," by Mr. G. E. Whitehouse.

Chemical Society.—Thursday, November 3rd. At Burlington House, Piccadilly, W.1. At 8 p.m. Ordinary scientific meeting.

Institution of Electrical Engineers.—Thursday, November 3rd. At the Institution, Victoria Embankment, S.W. At 6 p.m. Presidential address, by Mr. J. S. Highfield.

(East Midland Sub-Centre).—Tuesday, November 1st. At the Technical College, Derby. At 7 p.m. Paper on "Electric Traction," by Mr. J. Dalziel.

(Liverpool Sub-Centre).—Monday, November 7th. At the Liverpool University. At 7 p.m. Chairman's (Mr. G. H. Nisbett) address.

(Liverpool Students' Sub-Centre).—Thursday, November 3rd. At the University, Liverpool. At 7 p.m. Paper on "Transformer and Switch oils," by Mr. H. Butterworth.

Wednesday, November 2nd. Visit to the works of British Insulated and Helsby Cables, Ltd., at Helsby, Cheshire.

(Western Centre).—Monday, November 7th. At the South Wales Institute of Engineers, Park Place, Cardiff. At 6.30 p.m. Inaugural address by the Chairman, Mr. A. C. MacWhirter.

Chelmsford Engineering Society.—Thursday, November 3rd. At the East Anglian Institute of Agriculture. At 7 p.m. Paper on "Einstein's Theory," by Mr. T. L. Eckersley.

International Motor Exhibition.—November 4th to 12th. At Olympia, W., and the White City, Shepherd's Bush, W.

NOTES.

Educational.—UNIVERSITY OF LONDON.—The University College Calendar for Session 1921-22 gives an outline of the history of the college, by the late Dr. G. Carey Foster, as a preface. The *personnel* of the College Committee, Professorial Board, and details of departments and staff are given in full, as well as a list of Fellows. Following these are particulars of admission, scholarships, degrees, and courses. A list appears of post-graduate courses of lectures in numerous subjects. A catalogue of original papers emanating from the College is included, and, following a list of students, is the Provost's report for 1920-21 and proceedings at the Assembly of the Faculties.

Electrical Boilers.—Mr. J. D. Troup, M.I.Mech.E., in an article recently contributed to the *Manchester Guardian*, gave some details of electrical boilers based on the experiences of the Ateliers de Construction Oerlikon, of Zurich. The type of boiler preferably employed in dyeworks, breweries, &c., for heating water is multitubular, the elements being within the tubes while the water passes over the outside. The boiler cover and tubes form one piece, easily removed when cleaning becomes necessary. If the loading exceeds 300 kW, two or more boilers may be connected to work in parallel. The space occupied by these boilers is small. The 100-kW size is only 20 in. in diameter and 50 in. high. The boiler for steam raising is usually built with a loading of 500 kW. The heating elements are placed in a bunch in the lower part of a horizontal cylindrical shell which forms the boiler proper. The boiler shell in normal working is about three parts filled with water, and carries a steam dome. The Swiss authorities insist upon a margin of safety 50 per cent. above working pressure.

The Revel boiler, which utilises the heating effect of an electric current, takes the form of a vertical cylinder in which electrodes are immovably fixed. It may be supplied with power at 3,000 volts, and its efficiency is approximately 95 per cent. One advantage claimed for this type of boiler is that it can be switched on to the line, taking but a small starting current, which increases slowly to normal working.

The Electrical Industry and Unemployment.—The Joint Industrial Councils of the Electrical Industry, acting for the cable-making, electricity supply, and contracting branches, together with representatives of the Association of Electrical Manufacturers, the Wholesalers, and the Electrical Development Association, held a Conference on Monday, October 24th, to discuss the present conditions of unemployment in relation to the electrical industry, and to formulate measures which might be taken to secure the restoration of finance and trade within the industry and bring about alleviation of unemployment.

Sub-Committees were appointed to investigate details and collect information, and a further Conference will be held at the end of the week, when it is hoped to submit to the Cabinet Committee on Unemployment practical schemes on behalf of the electrical industry.

Fuel Economy.—The second issue of the *Fuel Economy Review* of the Federation of British Industries contains several articles of particular interest to manufacturers and others who utilise fuel for industrial purposes.

Although the *Review* was only issued for the first time in April in the nature of an experiment, it has met with such a favourable reception that its quarterly publication is assured, and this fact, in conjunction with its very moderate cost, should ensure its circulation amongst the management and technical staff of manufacturing establishments.

Our position as an industrial nation in the markets of the world is mainly governed by the price of coal, and the interests of the electrical industry in particular are dependent upon supplies of cheap fuel, the basic raw material for the production of energy.

The present cost of industrial coal is about three times the pre-war figure, and there is little hope of any very appreciable reduction in the near future, so that the more efficient utilisation of coal is absolutely essential if manufacturing costs in industrial establishments are to be maintained at an economic level.

In the current issue of the *Review*, Prof. Henry Louis contributes a valuable article on the economics of coal production, showing clearly the present unstable condition of the mining industry and the necessity for cheaper coal supplies as a vital factor of our national existence. The official statistics of production and costs are analysed by Dr. Louis, and it certainly appears that the official data published leaves much to be desired from an accountancy point of view. The article is most opportune, and should certainly be of great interest to boards of directors, works managers, and others responsible for the purchase of coal for industrial purposes.

The "water side of the boiler" is an article contributed by Mr. J. H. Paul, B.Sc., who is an expert in this particular subject, and demonstrates clearly the importance of correctly treating the feed water prior to its entrance into the boiler.

The first of a series of articles on fuel control in works deals with the methods employed at a typical soap and chemical factory, and it is intended to discuss the practice adopted in various types of works from time to time.

The purchase of coal under specification of calorific value forms the subject of an article dealing with American practice, and in this respect the U.S.A. authorities are certainly to the fore. When one considers the waste and inefficiency entailed in transporting millions of tons of dirt, stones, and water from the Midlands to the London area alone under the title of industrial coal, it seems almost absurd to think that our coal supplies are more or less controlled by a State department, and that factories and power stations are handicapped as a consequence and our transport systems congested.

An interesting article on the utilisation of waste heat is contributed by Messrs. Robert Nelson and A. H. Human, and the developments on the North-East Coast and in Yorkshire are briefly outlined. Further developments in the conservation of surplus neat from industries are necessary, and if co-operation with electric power supply authorities can be arranged, very appreciable economies in fuel will result.

The present issue concludes with a *résumé* of three typical investigations carried out upon steam-raising plant by the expert staff attached to the Fuel Economy Department of the F.B.I. It is hoped to publish practical data relating to the efficient operation of boiler plants from time to time, and the information thus given should prove useful to works managers and engineers.

The Fuel Economy Committee is also undertaking educational propaganda, and has already published several useful pamphlets and diagrams for the guidance of boiler-house staffs, whilst the chart showing the sensible heat loss in flue gases under various furnace conditions should prove useful in this direction.

Although this is only the second issue of the *Fuel Economy Review*, we feel convinced that it will attain a large circulation both in this country and overseas, and we should like to congratulate the Fuel Economy Committee on the excellent work it is doing for the benefit of our industries and the welfare of the nation.

The Petrol-Electric System.—At a conference of the Institute of Transport held in connection with the Commercial Motor Exhibition, Olympia, on October 17th, Mr. Percy Frost Smith read a paper on "The Evolution of the Motor Vehicle for Goods and Passenger Service." After a review of developments, the speaker said, according to a *Daily Telegraph* report: "Much is said about 'safety first,' and I can state confidently that the petrol-electric system is the acme of this; for example, if a vehicle is being driven in exceptionally dangerous country, as in some parts of Wales, Cornwall, or Devon, a driver may at his discretion put his controller in the reverse position, and crawl down a hill at a rate of about two to three miles per hour, without having recourse to his mechanical brakes. Equally, if the engine should fail in the centre of a dangerous hill, the vehicle cannot run backwards at a greater speed than that mentioned above, because the electric motor automatically becomes a dynamo for the time being. We are waiting for engines which will 'turn' faster, or preferably the internal-combustion turbine, which will then permit of the production of much lighter electrical sets for a given output. The present hand control of the dynamo field resistance will become automatic, an electric brake control, if one cares to use it, through the transmission shafts, can be easily provided, and if to-day the system cannot be considered absolutely fool-proof, it soon will be. My opinion is born of a strong conviction, the result of many years' experience of various forms of transmission. I believe that, in the absence of a force not yet known, or of a force not yet harnessed, in a few years from now petrol-electric transmission will occupy the position which the 'gear drive' holds to-day, and that is the end to which I, personally, am working."

The Swedish Housewives' Union.—The servant problem is as difficult in Sweden as here. But Sweden has an abundant supply of water-power, and her housewives are agitating for a provision of cheap domestic electric power and cheap electric labour-saving appliances. The matter has been taken up by the Swedish Housewives' Union, which is very practical in its methods. It realised that if it got the supply of electric power for cooking, sweeping, and ironing it would not be of much use unless it could also get the irons, stoves, and sweepers at a lower rate than the manufacturers were asking. So it called a conference to which it invited representatives of electric appliance makers. Eleven firms sent representatives, and the Union asked their help in the labour-saving scheme. It wanted them to make cheap appliances, and send them to an exhibition to be held in six months. Then the Union enlisted the help of a big housecraft school, whose experts examined the articles submitted. "This," they said, "is good. That one is wrong and must be altered to suit us." As a result a very large exhibition of electric appliances was held in Stockholm, and if they were not as cheap as the Union hopes they will become they were much cheaper than anything that had been shown before. In the following year one of the exhibitors recorded the sale of 800 electric appliances, and the scheme is now going well.—*Manchester Guardian.*

A Model Electric Restaurant.—On Tuesday last the directors of the Brompton & Kensington Accessories Co., Ltd., entertained a large party of visitors to dinner at the "B & K" Electric Restaurant, Earl's Court, London, with a view to demonstrating the capabilities of the magnificent new electric kitchen, which prepares 1,000 meals a day. The guests, who included Mr. J. S. Highfield, president of the Institution of Electrical Engineers, and Mr. A. Page, Electricity Commissioner, were conducted through the handsome restaurant, the well-equipped electric kitchen, and the workshops, by the chairman, Mr. H. R. Beeton, the chief engineer, Mr. R. S. Downe, and other members of the directorate and staff.

After the dinner—which, needless to say, was admirably cooked and efficiently served—Mr. Beeton, who presided, claimed that the B. & K. Co. was a pioneer in the promotion of the domestic accessory load, and had a ripe experience in respect of electric cooking. Thirty years ago he presided at a banquet on the occasion of the inauguration of the electricity works, the first high-pressure generating station in London; it was a purely residential area, and the improvement in the efficiency of glow lamps resulted in stagnation of revenue, compelling the company to embark on the missionary enterprise of educating the British public to the possibilities of electricity. It had secured 80 per cent. of the electric lighting possible in the area, and had 8,000 domestic consumers, but only 500 had as yet adopted electric cooking; consequently there remained an immense field, and 10 times the present output could be attained. The cooking load was highly profitable; heating was a seasonal load, overlapping lighting, and power was restricted to 47 hours a week, but cooking was always in progress, and overlapped lighting by only 10 per cent. in winter. Starting a restaurant was a bold step, but they did not regret it; by becoming cooks they learnt how best to design the apparatus. The present kitchen, one of the most complete and efficient in the world, was the third in succession. At 1½d. a kWh for cooking they were not losing money; the average cost to a householder was 5s. a week—very cheap, considering the quality of the service, and the excellent merits of the electrical method of cooking.

Mr. PAGE, in proposing success to the company, pointed out that the B. & K. system of distribution facilitated the use of heavy currents by consumers, and he believed that the method of distributing at a semi-high pressure and transforming on consumers' premises might have to be adopted elsewhere. The main concern of the Electricity Commissioners—reorganisation of areas and centralisation of generation—could only be successfully met by the co-operation of all parties interested and the wholehearted support of the industry.

Mr. HIGHFIELD said the company had undoubtedly adopted the right course. Other authorities had continuously reduced the price, but the whole income of the industry was collected from the public by the supply authorities, and they should increase the revenue by educating the consumers in electric cooking, &c., as that company had done. He had used electric cooking himself for 25 years.

Mr. DOWNE described the development of the restaurant from small beginnings, and its success, due to the excellent results obtained by electric cooking. The way to sell electricity was to supply the means of using it, and show consumers how to use it. Their undertaking was a centre of electrical activity, and a vast development of sales was anticipated.

A description of the equipment of the restaurant must be deferred to a later issue.

Speculative Construction of Electricity Works.—What appears to be a new method for the promotion of the construction and equipment of electricity supply works has just been proposed in Finland by three members of the Finnish Parliament, although the principle involved was common in Great Britain years ago before legislation put an end to speculative house building, and helped to bring about the present comparative scarcity of housing accommodation. The members in question have presented a petition to Parliament pointing out that the existing legislation of April, 1902, and April, 1909, in respect of electrical installations is very incomplete and antiquated having regard to the technical development which has taken place in the meantime. In particular, emphasis is laid on the absence in the orders of the year in question of any authority to mortgage electrical installations, except in certain cases, as security for loans or other obligations. As a consequence it is extremely difficult, if not quite impossible, to raise credit for electrical undertakings. Under these circumstances the petitioners ask Parliament to adopt a resolution instructing the Government to introduce a Bill to authorise the mortgaging of electrical installations, and at the same time to appoint an expert committee to inquire into and prepare a scheme for the amplification and amendment of the orders governing such installations.

The Law and Economic Committee of the Finnish Parliament, after an examination of the question, has associated itself with the proposal put forward by the petitioners, and states that recent economic development certainly demands legislative measures of the kind suggested. In the opinion of the committee the possibility of offering electrical installations as security for loans or other obligations necessary for the erection of works would increase in a high degree the opportunities for the establishment of such installations which would be calculated to facilitate the efforts for the electrification of the country. This circumstance is of all the more importance in Finland in consequence of the abundant resources in water power, which could be appropriately utilised for the production of light and power, but which cannot be fully utilised in another manner. Besides the supply of light and power the extension of such works would render the country independent of foreign sources for fuel, and would permit of the utilisation of credit in connection with fixed property, now so little used in Finland. The committee finally endorses the views of the petitioners and recommends Parliament to act in the matter as speedily as possible.

"Welcome Stranger."—Not for some considerable time has a new play been greeted with the complete favour which was accorded to Mr. Aaron Hoffman's comedy "Welcome Stranger" at the Lyric Theatre, Shaftesbury Avenue, W., on the night of October 19th. It is a clever enough play, says the *Daily Mail*, which does not make the mistake of being too clever. Its story is the old but ever-popular one of a man who succeeds with every man's hand against him.

Mr. Harry Green, that very amusing Hebrew comedian, is the man. In the character of Isidor Solomon he comes to a narrow-minded New England town with the object of opening a general store and making his fortune. It is New Year's Eve, and his reception in the town is as cold as the time of the year. But Isidor is not downhearted; he stays on, joins forces with a man who has a concession in respect to the local waterfall, and ends up by transforming the place into a veritable electric city. Our contemporary says Mr. Green is immensely amusing in a quiet, unassuming way, and his performance is one of the most genuinely humorous ones on the stage at the moment. He is full of comic and witty sayings; for example, "They's didn't want electric light here because I am an Israelite." Mr. George Elton, as the inventor, also gives an admirable performance; and Mr. Frank E. Petley, Mr. Sydney Paxton, Mr. Paul Arthur, and Mr. Robert Blythe help the piece along capitally.

Miss Margaret Bannerman is the girl in the play, and a very pretty, sympathetic girl she is.

A New Aluminium Solder.—We recently witnessed a demonstration of the soldering of aluminium by means of "Alubon" solder, a product of the Melvin Engineering Co., Ltd. This solder is supplied in three grades—soft, medium, and hard, according to the size and nature of the joint or repair to be made; cracks, blow holes, &c., in castings can be repaired in the same manner, and no flux whatever is required. "Alubon" is simplicity itself to use; the heating medium may be a blow-pipe flame or ordinary soldering iron. The surfaces to be joined are first cleaned and rough filed, heated, and then tinned with "Alubon" separately, using a coarse scratch brush to ensure perfect tinning and to clean off any excess solder. Next, the parts are set up in position, reheated, and more solder is run over the tinned parts, which completes the operation. Care must, however, be exercised to ensure that no movement of the parts will take place while soldering or until the joint has set. When set, the job can be cooled off in water without weakening or disturbing the joint, and it will withstand the test of boiling in distilled water. We attempted to fracture several joints which we saw made, but only succeeded in breaking the parent metal, the joints themselves remained good in each case. It should be mentioned that besides soldering aluminium and all of its alloys, the new solder is applicable to the soldering of copper or brass to aluminium.

An Electric Car for Factories.—The latest American novelty is a small single-seated electric motor-car for use in factories which cover a large area, so that the officials may be quickly transported from point to point. The car, which has been put on the market by the Automatic Transportation Co., 2,933, Main Street, Buffalo, N.Y., has the battery—capable of running a distance of 50 miles on one charge—under a bonnet in front of the driver. The wheel-base of the vehicle is only 5 ft. 5 in., and the track 2 ft. 11 in., so that it is small enough to pass through doorways and along the works' aisles without difficulty. It is also claimed that the car will effect a saving of time in the distribution of written instructions to various parts of large establishments.

INSTITUTION NOTES.

Institution of Electrical Engineers.—The programme for the first part of the 1921-22 session is as follows: Ordinary meetings: November 3rd, Mr. J. S. Highfield (president), inaugural address; November 17th, Mr. E. S. Byng, "Telephone Line Work in the United States." Wireless Section, November 9th, Dr. G. W. O. Howe (chairman), address. Informal meeting, November 7th, discussion on "How best to speed up electrical progress" (opened by the President).

North-Eastern Centre.—The opening meeting of the session was held at the Armstrong College, Newcastle-on-Tyne, on October 24th, when Prof. W. M. Thornton, O.B.E., D.Sc., delivered his inaugural address on "Electricity in Gases as a Branch of Engineering." The subject was illustrated with a series of experiments.

Western Centre.—The first meeting of the session will be held in Cardiff (South Wales Institute of Engineers) on November 7th, when Mr. A. C. McWhirter will deliver his inaugural address as chairman of the Centre.

Faraday House Old Students' Association.—The annual dinner of the Association was held at the Holborn Restaurant on October 21st, Mr. C. C. Paterson, O.B.E., the president, being in the chair. The toast of "Faraday House and Its Old Students" was proposed by Mr. Ll. B. Atkinson, and replied to by Dr. Alexander Russell. Mr. Partridge proposed the "Guests" in a very happy speech. He said that the industry had not yet fully recognised the debt it was under to Dr. S. Z. de Ferranti for his invaluable pioneering work in the early days. The toast was replied to by Dr. Ferranti and Sir John Snell.

Royal Society of Arts.—The new session will be opened on Wednesday next, at 8 p.m., when Mr. A. A. Campbell Swinton, F.R.S., chairman of the Council, will deliver an experimental address on "Wireless Telegraphy." Among the papers fixed for the meetings up to Christmas are the following:—

D. R. Wilson, secretary of the Industrial Fatigue Research Board, "The Work of the Industrial Fatigue Research Board."

Prof. J. A. Fleming, F.R.S., "The Coming of Age of Long-distance Wireless Telegraphy and some of its Scientific Problems" ("Sir Henry Trueman Wood" lecture).

Sir W. B. Townley, K.C.M.G., Minister to the Netherlands, 1917-19, "Trade with the Netherlands East Indies."

F. C. Wade, B.A., K.C., Agent-General for British Columbia, "British Columbia: The Awakening of the Pacific."

Association of Mining Electrical Engineers.—The Lothians Branch of the Association opened the new session in Edinburgh with a social evening, when there was a large gathering of members and friends, including representatives from the West and East of Scotland, and Fife Centres. Mr. Henderson, in the absence of Mr. Milligan, the retiring president, was in the chair and presented by Mr. G. A. McLennan with prizes awarded by the Association for the best paper of the session, "Power Factor Control in Practice." Mr. F. Sims, the new president, gave his inaugural address.

Association of Consulting Engineers.—The annual dinner of the Association, which was postponed owing to the coal miners' strike, will be held on November 24th at the Engineers' Club, Coventry Street, W.

Chelmsford Engineering Society.—The opening meeting of the Society took place on October 13th under the chairmanship of Mr. G. F. Barrett, O.B.E., managing director of the Hoffmann Manufacturing Co. Mr. G. B. Petter, A.R.C.S., read a paper on the Vickers-Petter oil engine, in the course of which he gave some very interesting facts and data. The lecture was illustrated by lantern slides. Mr. Petter explained that the engine worked on the two-stroke cycle with hot-bulb ignition, and was made in the vertical type only for marine and land use. A useful discussion followed, and Mr. Petter replied to the questions raised.

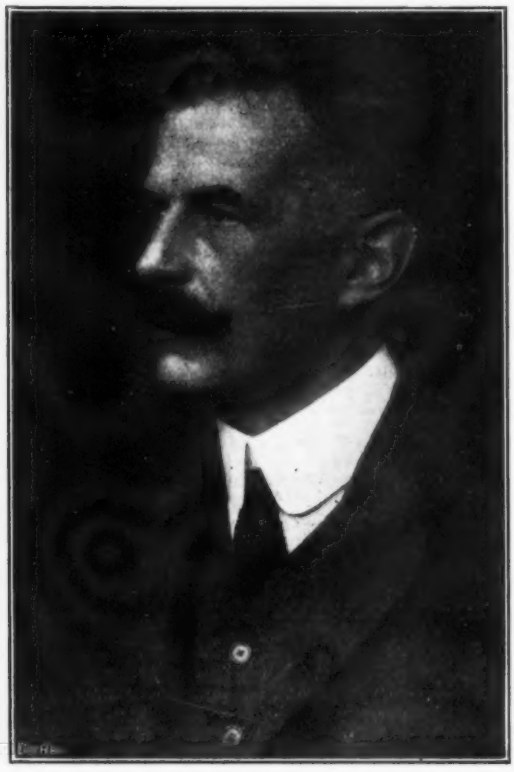
Edinburgh Electrical Society.—At a meeting on October 14th Mr. R. W. J. Stark read a paper on "Electrochemistry." Various processes for extracting gases from the air were described, and the lecturer dealt with electrolysis as applied to the manufacture of industrial chemicals. The processes of electro-plating, electro-typing, and the refining of copper were described.

On October 22nd the Society visited the Niddrie and Benhar Colliery at Newhailes. After inspecting the power house, the party descended a shaft and visited some of the hauling and pumping stations.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the comercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Mr. William Lionel Hichens, whose views on industrial problems have been expressed with frankness during the last few years, and have so frequently formed the subject of articles in the pages of the Electrical Review, has been the chairman of Messrs. Cammell, Laird & Co., Ltd., since 1910, and he is to-day also vice-chairman of the English Electric Co., Ltd. At the recent meeting of the British Association for the Advancement of Science he presided over the Economic Science Section, and his contributions to the proceedings there aroused widespread interest and formed the basis for comment in our editorial pages last week and they do so again to-day. During the war Mr. Hichens was outspoken and thorough in his criticisms of Government control of industry, the dangers that were inevitable if it continued, and the fallacies underlying the advocacy of nationalisation. The subject of wages in



Mr. W. L. Hichens.
(Vice-chairman of the English Electric Co., Ltd.; Chairman of Messrs. Cammell, Laird & Co., Ltd.)

relation to industry was dealt with in a useful paper read by him at the Royal Society of Arts a year or two ago, and he has welcomed opportunities for debating industrial matters with labour leaders on the public platform. As a layman he has addressed meetings of men in the churches on the problems which, as a manufacturer and industrial leader, he has made his own. He was one of the engineering manufacturers who recently went North to confer with the Prime Minister on the industrial situation, unemployment problems, and trade revival. Born in the year 1874, Mr. Hichens was educated at Winchester and at New College, Oxford. He was a member of the Egyptian Ministry of Finance, Colonial Treasurer of the Transvaal, and Treasurer of the Inter-Colonial Council of the Transvaal and Orange River Colony. In 1907 he went to India as a member of the Royal Commission on Decentralisation. He acted as chairman of the board of inquiry held into the public service of Southern Rhodesia in 1909. In addition to his interests in industrial undertakings already mentioned he is a director of the London & North-Western Railway, a member of the Advisory Committee to the Department of Overseas Trade, deputy chairman of the Disposals Board, and a member of the Carnegie Trust.

Mr. R. W. Hayman, A.M.I.E.E., manager of the export department of Messrs. Simplex Conduits, Ltd., paid a visit to South Africa in the early part of the year to investigate the possibility of increased business. We are informed that the results were so satisfactory that Mr. Hayman is returning in charge of the Simplex permanent interests throughout the Union.

The marriage took place on October 18th, in London, of Mr. Henry Nimmo, M.I.E.E., electrical engineer, Public Works Department, Burma, to Miss Una Kathleen Barron, elder daughter of Mr. and Mrs. R. B. Barron, of Quendon, Essex.

Mr. A. E. Davis, of 5, Cavell Road, Dudley, has joined the permanent staff of Price's Electrical Supplies, Ltd., 58, Great Charles Street, Birmingham, as their representative in the Black Country.

Mr. W. A. Toppin is leaving the Chesterfield Corporation electricity department shortly, after four years as assistant manager, to start in business on his own account. He was previously 12 years with Greenock electricity department, and six years with large contractors.

Major Charles Mitchell has been appointed a director of Sir W. G. Armstrong, Whitworth & Co., Ltd.

Mr. T. R. Whitehead, manager of the Coventry Corporation Tramways, who has completed 25 years' service, has been presented by the Tramway Committee with an inscribed silver fruit dish.

Mr. J. J. Smith, who resigned the appointment of borough electrical engineer at Stockton-on-Tees last June, has been presented with a silver tray by the officials and electricity works staff.

Col. O. C. Armstrong, D.S.O. (chairman of Messrs. Greenwood & Batley, Ltd.), has been recommended by the Grand Council for the position of president of the Federation of British Industries, in succession to Sir W. Peter Rylands, who retires from the office at the annual meeting on November 23rd, after two years in the presidential chair. Col. Armstrong, who saw many years' military service in the South African war on the staff of Lord Kitchener, became a managing director of Messrs. William Beardmore & Co., Ltd., in 1909, on his retirement from the post of financial adviser at Headquarters in India. In 1914 he left his Beardmore position to become chairman of Messrs. Greenwood and Batley, Ltd., Leeds, which office he now holds. Among other positions he has held are the following: Vice-president of the Federation of British Industries; chairman of the British Engineers' Association; chairman of the Mechanical Engineering Group of the Federation of British Industries. The following members of the F.B.I. have been recommended to the annual general meeting for election as vice-presidents of the F.B.I.:—Lord Weir and Sir John Hunter (Glasgow District); Sir Tom Callender (Electrical Industry); Sir Harris Spencer (Birmingham District); Sir Wilfred Stokes (chairman, De-Controlled Firms Committee); Mr. Lennox Lee (chairman, Manchester District); Mr. Peter MacGregor (chairman, Sheffield District); Mr. Clive Cookson (chairman, Newcastle District); Mr. Alex. Johnston (chairman, Edinburgh District).

Obituary.—Senator Frederic Nicholls.—The death occurred on Tuesday, at the age of 65 years, of Senator Frederic Nicholls, president of the Canadian General Electric Co., and connected with many other important manufacturing, power, traction, and other undertakings in Canada.

NEW COMPANIES REGISTERED.

Cesco, Ltd. (177,314).—Private company. Registered October 17th. Capital, £6,000 in £1 shares. To adopt agreements with A. H. Smith and G. W. Matthew (1) for the acquisition of the business of the Commercial Electrical Supplies Co., and (2) relating to their appointment as permanent joint managing directors, and to carry on the business of electricians, mechanical engineers, suppliers of electricity for light, heat, motive power, or otherwise, &c. The permanent joint managing directors are: A. H. Smith, 13, Station Road, Penarth; G. W. Matthew, 57, Hamilton Street, Cardiff. Solicitor: R. W. Nicholas, 31, Queen Street, Cardiff.

Broadbents Patents Co. (Southport), Ltd. (177,273).—Private company. Registered October 14th. Capital, £2,000 in £1 shares (1,000 preference). To adopt an agreement with D. L. J. Broadbent, and to carry on the business of electricians, mechanical engineers, suppliers of electricity, &c. The permanent governing directors are: W. Teague, 18, Pilkington Road, Southport, engineer; D. L. J. Broadbent, 26, Scarisbrick Avenue, Southport, engineer. Qualification, £1,000. Remuneration, £50 each per annum. Registered office: 7b, King Street, Southport.

"A. O." Reflector Co., Ltd. (177,345).—Private company. Registered October 19th. Capital, £3,000 in £1 shares. To adopt an agreement with C. H. Keane, to acquire the "A. O." reflector referred to therein, and to carry on the business of manufacturers of and dealers in light reflectors and diffusers, &c. The subscribers (each with one share) are: F. W. Stevenson, 18a, Leinster Terrace, W.2, director; C. H. Keane, 22, Praed Street, W., sales manager. The first directors are: F. W. Stevenson, C. H. Keane, and S. J. Frost. Qualification: £250. Remuneration: £50 each per annum. Registered office: 18a, Leinster Terrace, W.2.

Davis Electrical Co., Ltd. (177,301).—Private company. Registered October 15th. Capital, £1,000 in £1 shares. To carry on the business of manufacturers, exporters and importers of, agents for and dealers in gas and electric light and heating apparatus, &c. The first directors are: J. Davis, 37, Frobisher Road, Hornsey, N.8; Mrs. Madge Davis, 37, Frobisher Road, Hornsey, N.8. J. Davis is permanent, subject to holding 200 shares. Registered office: 6, Warwick Court, Grays Inn, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Technical & Electrotechnical Wholesale Trade, Amsterdam, Ltd. (Telga, Ltd.) (2,017F).—Particulars filed October 15th. Capital, fl. 100,000 in 100 shares of fl. 1,000 each. Registered in Holland on November 14th, 1919, to trade in electrotechnical machinery and requisites, metal goods, and all products of the technical industry, &c. British address: 4, Union Street, Wells Street, Oxford Street, W.1, where E. C. Beman is authorised to accept service. Directors: W. A. P. F. L. Mals (senior), P. J. Schut, T. A. H. Stom, and F. A. Wolf, all of Amsterdam.

New Welding Co., Ltd.—Particulars of £500 debentures, authorised October 10th, 1921; present issue, £150; charged on the company's undertaking and property, present and future, including uncalled capital.

Torquay Tramways Co., Ltd.—Satisfaction to the extent of £1,100 on September 30th, 1921, of charge dated March 8th, 1911, securing £60,000.

Bastian Electric Co., Ltd.—Particulars of £1,500 debentures, authorised July 11th, 1921; whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital.

Threadgill Electro Deposits, Ltd.—Particulars of £3,000 debentures, authorised October 1st, 1921; whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital.

Wimbledon Electrical Co., Ltd.—Particulars of £800 debentures, authorised October 12th, 1921; whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital.

Mersey Power Co., Ltd.—Issues on various dates from March 23rd to October 5th, 1920, of £80,000 debentures, parts of a series (notice filed October 15th, 1921). Satisfaction in full on October 4th, 1921, of debentures dated January 28th to October 5th, 1920, securing £100,000 also notified.

General Electric Co., Ltd.—Four land registry charges on certain land and premises at Brook Green, Hammersmith, dated October 12th, 1921 (supplemental to trust deed dated July 22nd, 1921, securing £3,500,000 debenture stock). Trustees: London City & Midland Executor and Trustee Co., Ltd.

Edison Swan Electric Co., Ltd.—Deed dated October 8th, 1921 (supplemental to trust deed dated June 19th, 1900), to secure £100,000 additional second debenture stock, charged on property, comprised in prior deeds of June, 1900, and November, 1909. Trustees: London Trust Co., Ltd.

Yale Electric Power Co., Ltd. (60,493).—Return dated October 12th, 1921. Capital, £20,000 in 3,300 preference shares of £1 each and 668 ordinary shares of £25 each; 300 preference and 668 ordinary shares taken up; £15,300 paid. £1,700 considered as paid. Mortgages and charges: £6,000 debentures as security for bank overdraft.

Spanish Telephone Co., Ltd. (41,589).—Return dated July 14th, 1921. Capital, £81,000 in £5,600 ordinary shares of £10 each and 1,250 preference shares of £20 each; 5,600 ordinary and 671 preference shares taken up; £53,420 paid; £16,000 considered as paid Mortgages and charges: Nil.

Walters Electrical Manufacturing Co., Ltd. (94,300).—Return dated September 7th, 1921. Capital, £18,000 in £1 shares; 16,875 shares taken up; £6,875 paid; £10,000 considered as paid. Mortgages and charges: Nil.

Delhi Electric Tramway & Lighting Co., Ltd. (88,758).—Return dated June 30th, 1921. Capital, £170,000 in £1 shares (140,000 preference and participating and 30,000 ordinary); 100,000 preference and participating and 29,000 ordinary shares taken up; £100,000 paid, £29,000 considered as paid. Mortgages and charges: £50,000.

Marconi International Marine Communication Co., Ltd. (65,759).—Return dated August 18th, 1921. Capital, £1,500,000 in £1 shares; 1,192,726 shares taken up; £1,087,726 paid, £105,000 considered as paid. Mortgages and charges: £61,120.

Sheerness & District Electric Power & Traction Co., Ltd. (65,749).—Return dated June 21st, 1921. Capital, £75,000 in £10 shares (5,000 ordinary and 2,500 preference); 5,000 ordinary and 2,473 preference taken up; £74,730 paid. Mortgages and charges: £28,280.

CITY NOTES.

German Companies.

The directors of the *Elektrotechnische Fabrik Rheydt* (*Max Schorch & Co.*), of Rheydt, recommend the payment of a dividend for 1920-21 at the rate of 10 per cent., as in the previous year.

The Kabelwerk Rheydt, of Rheydt, report net profits of 9,124,000 marks for 1920-21, as compared with 8,705,000 marks in the preceding year. The dividend is at the rate of 20 per cent on capital of 24,000,000 marks, as against 30 per cent. on less capital in 1919-20.

The Export-A.G., of Berlin, which is engaged on the sale of electrical manufactures in England and in countries outside Europe, reports net profits of 824,000 marks for 1920-21, contrasting with 563,000 marks in the previous year. The share capital is now being increased to 3,000,000 marks. It is stated in the annual report that the company has formed closer relations in England, has gained a firm footing in South Africa and the Levant, and has entered upon the new financial year with orders on hand of the value of 6,000,000 marks.

The report of the *Wotan Werke A.G.*, of Leipzig, states that it was possible in particular to increase the export sales in 1920-21. Orders in the final months of the year were inconsiderable, but business has greatly improved in the new financial year, and the contracts on hand will fully occupy the works for several months. After making provision for depreciation, the accounts show net profits of 3,080,000 marks, as compared with 1,714,000 marks in 1919-20, and the dividend is at the rate of 40 per cent., as in the previous year, on share capital increased from 3,500,000 to 7,500,000 marks.

Stock Exchange Notice.—Applications have been made to the Stock Exchange Committee to allow the following to be officially quoted:—

Lancashire Electric Light and Power.—Partly-paid scrip for £400,000 seven-and-a-half per cent. prior lien debenture stock.

Herbert Morris, Ltd.—A further dividend on the ordinary shares is recommended, making 10 per cent., free of tax, for the year ended July, 1921. £25,000 to reserve. £20,294 carried forward. The stocks have been written down.

Erinoid, Ltd.—In their report for the year ended August, 1921, the directors state that to ensure sufficient supplies of raw material to keep the factory going in 1920 the general managers thought it necessary to make substantial forward contracts. Cancellation of orders and reduction in sales arising out of the unprecedented slump which began to affect the company in December last left the company with an accumulation of raw material which was totally unexpected and unavoidable. A drastic policy in writing down the whole of the stocks (manufactured and unmanufactured) to present cost has been adopted. According to the *Financial Times* the trading profit for the year, bringing in the stock at original cost, amounted to £16,717, and after allowing for company charges, depreciation on plant and machinery, and losses of a capital nature, the net loss of £12,387 has been carried to balance-sheet. Deducting the credit balance brought forward, the net loss to carry forward is £9,718.

The Electric Supply Co. of Victoria, Ltd.—The report for the year ended March, 1921, shows that the lamps connected increased from 268,544 to 312,520; the passengers carried on the tramways advanced from 5,316,136 to 6,096,269. The trading account shows that the revenue advanced from £105,053 to £124,994, the expenditure from £69,712 to £85,295, and the gross profit from £35,341 to £39,699. The balance to credit of profit and loss is £35,825, plus £32,604 brought forward, making £68,429. Out of this, debenture interest absorbs £5,568; debenture stock redemption account £8,325; and there is written off cost of debenture issue £450, leaving £54,085. After paying £10,500 on account of arrears of 6 per cent. cumulative preference dividend, £43,585 is to be carried forward. The amount still in arrear and due on preference shares is £10,500. The preference capital is £175,000. The total debenture stock redeemed to date is £90,287. The meeting was held in London on October 13th.

Montreal Companies.—A dividend of $1.25 per share has been declared by the Montreal Light, Heat & Power Consolidated Co., and one of $2 per share by the Montreal Light, Heat and Power Co.

Calcutta Electric Supply Corporation, Ltd.—An interim dividend of 8 per cent. per annum, less tax, on the ordinary shares is announced for the past half-year.

Callender's Cable & Construction Co., Ltd.—The directors announce an interim dividend of 1s. per share, less tax, on the ordinary shares.

American Telephone & Telegraph Co.—According to a *Times* report from U.S.A., this company is asking for authority to issue $50,000,000 of 20-year six-and-a-half per cent. refunding bonds.

Shanghai Mutual Telephone Co., Ltd.—This company announced an extraordinary general meeting for October 17th, at which an increase of the company's capital to 2,000,000 taels by the creation of 20,000 new shares of 50 taels each, in addition to the 20,000 like shares already existing, was to be proposed.—*Reuter's Trade Service.*

Belgian Companies.—The report of the Société d'Electricité de l'Est de la Belgique for the year ending June 30th last shows a profit of 212,746 fr., as compared with only 67,820 fr. in the preceding twelve months.

The balance sheet of the Société de l'Electricité de la Dendre, of Brussels, for the year ending June 30th last shows a profit of only 15,274 fr., as compared with 17,952 fr. in the preceding twelve months.

Marshall, Sons, & Co., Ltd.—In view of the continued trade depression no interim dividend on the ordinary shares is to be paid.

Brampton Bros., Ltd.—Dividend of 10 per cent., free of tax, on the ordinary shares, £10,000 to reserve, and £8,608 carried forward.

Calcutta Tramway Co.—According to the "Financial Times," the usual interim distribution on the ordinary shares is not to take place, the question of dividend being left over until the result of the complete year is known.

West African Telegraph Co., Ltd.—The loss for the year 1920 was £27,636. The debit balance is £26,777, which has been charged against general reserve.

Monte Video Telephone Co., Ltd.—Final dividend of 5 per cent., free of tax, making 8 per cent., free of tax.

Babcock & Wilcox, Ltd.—Dividend of 7 per cent., free of tax, for the half-year ended June.

STOCKS AND SHARES.

Tuesday Evening.

It may be said at once that there is no particular activity in any of the Stock Exchange markets, excepting those concerned with gilt-edged stocks. Investment continues to make itself felt in various directions, though there is not sufficient of this class of trade to keep things moving. Ireland, Hun-

gary, and Silesia are quoted as a trio of reasons for imposing fresh caution on the part of the public with regard to their Stock Exchange adventures. The Government's scheme for unemployment has evoked an ambitious scheme of extension from the Underground Electric Railways of London, a scheme which has been read with keen interest by everyone concerned with railway work. It has had, however, no effect in making Underground stocks any better. Indeed, prices are slightly lower than they were a week ago.

Creation of new capital on a large scale would be the natural sequel if the Government were to fall in with the plan proposed by the Underground company. This would mean placing new obligations in front of the stocks and shares at present issued, and the latter have accordingly weakened in price. The Stock Exchange market, however, is inclined to regard the company's proposal as scarcely likely to commend itself to the Cabinet. This is a matter, of course, for which attention will wait upon the Cabinet's decision. Meanwhile, some of the electric lighting companies are bestirring themselves to see whether they also cannot claim some share of the Governmental assistance, for the lightening of the unemployment burden, through the medium of obtaining capital at reasonable rates that shall enable them to put in hand the various plans of extension which have been more or less held in suspense owing to the incidence of the war and its aftermath.

One of the principal firms of Stock Exchange jobbers steps into the breach at this psychological moment with the issue of a circular, sent round to many Stock Exchange brokers. In this it draws attention to the securities of the electric lighting and power companies as being amongst those which, it contends, offer many favourable opportunities for investment at the present time, not only as compared with other securities in the industrial market, but intrinsically in themselves. The restrictive nature of the early electricity legislation, due to the municipalising views of the Government of that time, led to slowness of growth in the industry, in that it involved an uncertainty of tenure which retarded the initiative development that would otherwise have taken place. Of recent years, however, great changes have occurred, and, during the war, the value of electric energy as an active power was fully recognised. The firm argues that the passage of the Electricity Supply Act of two years ago manifested the Government's aim to help the electric supply industry. The result of the Act, according to its view, will make it possible for companies to arrange to undertake reasonable capital expenditure, with sufficient security against being bought out by a local authority before adequate return on the expenditure has been received.

So far as price changes on the week go, there are few to be noted in the list of London shares. It is timely, while people are investing money much more in fixed-interest shares than those of the ordinary class, to show what the market offers in the way of preference issues at the moment. The following examples give a representative idea of what can be obtained, and in each case there is a reasonable supply of stock for those who care to buy it:—

Preference.	Div. %	Due.	Price.	Yield. £ s. d.
Calcutta Elec. Supply ...	5*	M. & S.	16/9	8 10 0*
City of London Elec. 2nds ...	8	M. & S.	23/3	6 17 6
Clyde Valley 2nds	8	J. & D.	10	8 0 0
County of London Electric ...	6	M. & S.	7 1/8	7 10 0
Lancashire Power 1sts ...	6*	M. & N.	17/6	9 15 0*
Melbourne Electric ...	8	F. & A.	5 1/16	7 17 6
North Metropolitan Electric...	6	A. & O.	14/9	8 15 0
St. James' and Pall Mall Elec.	7	F. & A.	4 1/16	7 2 6
Westminster Electric... ...	4½	J. & J.	3⅞	6 5 0
Indian Electric	7	J. & J.	16/9	8 5 0

* Free of tax.

Dividends on the above are cumulative, except in the cases of the North Metropolitan, St. James's and Indian shares.

Marconi shares are flat at 30s., and Marconi Marines have fallen to 17s., the wireless group as a whole being decidedly off-colour in consequence of a slight pressure to sell. The tendency amongst investors becomes more and more pronounced in favour of fixed-interest stocks and shares, debentures, preference, notes, &c., and with so small a measure of support accorded to ordinary capital, it takes very little offering of stock to put prices down. This is the main reason for the weakness in the Marconi lists, and it can also be applied to other stocks and shares, depression in which may lead to perplexity in the minds of shareholders as to the reason for the constant fall in values.

Electrical manufacturing shares are mainly heavy. In the dulness which has spread over the market, a few of the preferences have also eased off, General Electrics, for instance, giving way to 16s. 6d. or 6¼ per cent. and 7¼ per cent. shares alike. The ordinary have fallen to 15s. English Electrics dropped to 8s. 3d., the preference to 11s. 3d. Transactions in the latter have been marked at half-a-guinea. British Aluminium at 14s. 3d. are 9d. down; shares changed hands at 13s. 4½d. India-Rubber shares weakened to 13s. 9d., and Siemens to 20s. Babcock & Wilcox are unchanged at 2½. An interim dividend is declared of 7 per cent., being the same rate as that of a year ago. Iron, coal and steel shares are generally heavy, in consequence of the opinion that, with so many men out of work, companies must be badly hit as regards their profits. It is the continual selling of such shares by people tired of holding them, and the diversion of the money thus obtained into war stock and similar securities, that accounts for the strength shown by the gilt-edged group.

Mexican bonds and shares are generally lower, and Brazilian Tractions at 27 show a drop of 2 points, owing to the manner in which the value of the milreis has receded. No changes worth mentioning have occurred in the British Columbian group. Anglo-Argentine Tramway second preference at 2 11/16 are 1/16 down.

The cable group is inclined to droop. Westerns at 16½ have lost the 5s. which they added to their quotation of last week, and Great Northerns at 24 are 10s. lower. Globes at 16½ are ¼ down; United River Plates at 5¾ are similarly weaker. Cuba Submarines at 7 have shed 5s., Anglo-American Telegraph deferred shows ½ fall, and the preferred is 2 points down at 85.

The rubber share market is disposed to be a little better, owing to the efforts which are being made to obtain control of the selling price, and of the output of the produce. It cannot be said, however, that business in rubber shares displays any inclination to improve, and the Stock Exchange market is fain to content itself with saying that there is more tone than trade. Amongst new issues, the principal feature is a rise to 5 premium in County of London 7 per cent. debenture. Lancashire Power debenture remains steady at 3 premium.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1919.	Dividend 1920.	Price Oct. 25, 1921.	Rise or fall.	Yield. £ s. d.
Home Electricity Companies.					
Brompton Ordinary	12	12	6⅜	—	39 8 2
Charing Cross Ordinary	7	8	4⅜	—	9 2 4
do. do. do. 4½ Pref.	4½	4½	9¼	—	7 4 4
Chelsea	4	6	8½	—	9 4 8
City of London	13	14	1 7/16	—	10 13 4
do. do. 6 per cent. Pref.	6	6	17/6	—	6 17 2
County of London	8	8	8½	— ¼	9 10 4
do. do. 6 per cent. Pref.	6	6	7½	— ¼	7 10 0
Kensington Ordinary	7	9	6⅜	+ ¼	9 14 6
London Electric	2½	2½	1	—	7 10 0
do. do. 6 per cent. Pref.	6	6	3	+ ¼	10 0 0
Metropolitan	6	7	5⅝	— ¼	9 0 8
do. 4½ per cent. Pref.	4½	4½	2 1/16	—	7 13 2
St. James' and Pall Mall	12	12	6⅜	—	9 1 4
South London	6	7	3⅜	— ¼	10 13 2
South Metropolitan Pref.	7	7	12/9	—	8 17 10
Westminster Ordinary	10	10	6½	—	8 13 10
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	85	—2	7 1 2
do. Def.	1½	1½	17⅜	— ¼	8 12 6
Chile Telephone	6	6	5⅝	—	5 14 8
Cuba Sub. Ord.	7	7	7	— ½	10 0 0
Eastern Extension	10	10	16½	—	6 1 0
Eastern Tel. Ord.	10	10	166¾	—	6 0 1
Globe Tel. and T. Ord.	10	10	16½	— ¼	6 1 0
do. do. Pref.	6	6	9⅛	—	6 9 9
Great Northern Tel.	22	24	24	— ½	10 0 0
Indo-European	10	10	30	—	8 8 8
Marconi	25	15	1½	— ¼	10 0 0
Oriental Telephone Ord.	12	12	2	—	*6 0 0
United R. Plate Tel.	8	8	5¾	— ¼	*6 19 2
West India and Panama	Nil	Nil	6/-	—	Nil.
Western Telegraph	10	10	10½	— ½	*6 1 0
Home Rails.					
Central London Ord. Assented	4	4	49⅛	—	8 1 8
Metropolitan	1½	1½	23½	— ¼	6 7 8
do. District	Nil	Nil	16¾	—	Nil
Underground Electric Ordinary	Nil	Nil	1⅞	— ⅛	Nil
do. do. "A"	Nil	Nil	5/-	—9d.	Nil
do. do. Income	4	2	60½	—1	*4 6 4
Foreign Trams, &c.					
Anglo-Arg. Trams, First Pref.	5½	12½	25	—	10 9 6
do. do. 2nd Pref.	Nil	5½	2 1/16	— 1/16	10 4 8
do. do. 5 % Deb.	5	5	65½	—	7 17 0
Brazil Tractions	Nil	Nil	27	—2	Nil
British Columbia Elec. Rly. Pfds.	5	5	60	—	8 6 8
do. do. Preferred	5	93/-	53½	—	*8 14 2
do. do. Deferred	3	124/-	84	—	*11 8 6
do. do. Deb.	4½	4½	60	—	7 1 8
Mexico Trams 5 per cent. Bonds	Nil	Nil	27	—2	—
do. 6 per cent. Bonds	Nil	Nil	27	—2	Nil
Mexican Light Common	Nil	Nil	9	—	Nil
do. Pref.	Nil	Nil	25	—1	Nil
do. 1st Bonds	Nil	5	50½	—3	9 10 6
Manufacturing Companies.					
Babcock & Wilcox	15	16	2½	—	7 2 3
British Aluminium Ord.	10	10	14/3	—9d.	—
British Insulated Ord.	15	15	1½	—	10 0 0
Callenders	15	15	1 7/16	—	10 8 8
,, 6½ Pref.	6½	6½	18/9	—	6 18 8
Crompton Ord.	10	10	14/6	—	13 15 10
Edison-Swan	10	—	6/9	—	—
do. do. 5 per cent. Deb.	5	5	68	—	7 7 1
Electric Construction	10	10	16/9	—	16 17 6
English Electric	8	8	8/3	— ⅛	19 8 0
Do. Pref.	6	6	11/3	—3/8	10 13 4
Gen. Elec. Pref.	6¼	6¼	15/-	—1/6	7 8 6
do. Ord.	10	10	15/-	—1/6	13 6 8
Henley	15	15	1 7/16	—	10 5 0
do. 4½ Pref.	4½	4½	8½	—	6 13 6
India-Rubber	10	—	1/16	— ¼	—
Mex.-Vickers Pref.	8	9	1½	—	8 16 2
Siemens Ord.	10	10	1	— 1/16	*10 0 0
Telegraph Con.	20	20	21½	—	*5 11 9

* Dividends paid free of Income Tax.

ELECTRICAL ENTERPRISE IN SPAIN.

Scheme for Railway Electrification Adopted.

A Market for British Electrical Goods Available, but Recent Legislation may adversely affect Foreign Contracts.

By PERCY F. MARTIN, F.R.G.S.

The possibility and practicability of the construction by the Spanish Government, directly or indirectly, of a national system for the distribution of electricity has long engaged the attention of the responsible authorities. As far back as 1919, a permanent Spanish Electric Commission was appointed for the purpose of drawing up a report, which was also to embrace expert conclusions regarding the utilisation of fuel of an inferior quality and low price, or of coal which occurs in regions incapable of being exploited owing to their remoteness from consuming centres. That the recommendations submitted have not been carried into effect is largely due to the paucity of funds. Although strongly endorsed by the late Minister of Public Works, whose grandiose scheme for public enterprises brought about his political downfall, Congress incontinently refused to sanction the various undertakings, among them a wide electric system.

As conceived by the Commission, this system would be a series of transmission lines passing through all, or nearly all, the important consuming centres found on the north or south coast, with radial lines to Madrid, the capital, and practical geographical centre of the country. Power would be generated at the larger waterfalls, and also at mines where coal of too low a grade to be exploited commercially could be used to produce energy cheaply by being burned at the mine-shaft. These steam central stations would be used principally during the droughts which occur at certain seasons in all parts of Spain, one of the worst having been experienced this summer, and, in this manner, there would be an abundance of power during the entire year.

Although rejected in its entirety, the Commission's scheme for a national electric system is about to be adopted in part, the necessary funds having been raised by means of a foreign loan, and work will be commenced this winter mainly for the purpose of finding employment for the immense army of distressed labourers who, as in other countries of Europe, find themselves without work. It is recognised that one of the great advantages to be derived from a national system of electric transmission, apart from the continuous supply of cheap power to all users, both large and small, would be the unification of the frequency and voltage. The former is now standardised at 50 cycles, 3-phase, throughout Spain, and the latter will be regulated after further study of the needs of the principal industries. For the main branches of the transmission line it is recommended that the pressure be not less than 120,000 volts.

It would appear that there are available some 2,000,000 kilowatts, without taking into consideration waterfalls of less than 2,000 kW. The most important of the rivers to be exploited are found upon the slopes of the Pyrenees; the number of kilowatts is put at 490,000. Next in importance is the Duero river, on the Portuguese frontier, expected to give 150,000 kW, while the Ebro, from Saragossa to the Mediterranean, should give 130,000 kW, and the Tagus 110,000 kW. The importance of the Duero river may be gauged from the fact that apart from the 150,000 kW derived from the stream on the Portuguese frontier, tributaries provide a further 50,000 kilowatts, and the river, in its course through Spanish territory, a further 90,000 kW. Other rivers of importance are the Guadalquivir and smaller Andalusian streams, contributing 40,000 kilowatts, while various falls of minor importance are expected to make available a further 500,000 kW.

With regard to the estimated cost of lines, it is thought that there will be 888 miles of wire, having a cross-sectional area of 50 square millimetres (0.08 sq. in.), and 1,100 miles of wire with a cross-sectional area of 100 square millimetres (0.16 sq. in.). The lines will be laid in duplicate throughout, protected by an earth wire, and provided with four telephone circuits. In all probability the posts will be of concrete and steel, spaced at an average distance of 410 ft., while the type of insulator considered best for the purpose is the suspension type, six elements in series.

The engineering plan to make the river Guadalquivir productive of energy calls for the construction of 11 dams of the Stoney gate system, such as have been constructed on the Rhine and upon rivers in France and Switzerland. The 11 installations proposed will be as follows: Alcalá del Rio, Cantillana, Alcolea del Rio, Peña de la Sal, Lora del Rio, Peñaflor, Palma del Rio, Posadas, Guadiato, Villarrubia, and Cordoba. With these installations an annual power production of 202,000,000 kWh could be realised. The chief engineer (Señor José García Otéro) calculates that the maximum time required for the completion of the vast Guadalquivir river works will be 20 years; but he believes this may be shortened by the increasing demand for electric power.

In the meantime, it has been decided to proceed with the electrification of the railway lines owned by the Compañia de los Ferrocarriles de Santander à Bilbao, extending between Bilbao, Las Arenas, and Plencia, a distance of approximately 26 kilometres. Power is available at three points—Bilbao, Luchana, and Las Arenas—for the supply of power to the Bilbao-Algorta division, and sub-stations will be established at all of them, while an additional sub-station will be required between Algorta and Plencia to furnish energy to that division. Power will be purchased from the Hidro-electrica Iberica, S.A., consisting of 3-phase, 50-cycle current at 3,000 volts. Passenger trains upon this line are ordinarily run on a 30-minute schedule; but under electrification the time will be reduced to a 15-minute schedule, and the running time materially lessened. Additional services are provided on holidays and feast-days. All passenger trains consist of a locomotive and five cars, each car weighing empty 10 tons, and when loaded 12 tons. The track-gauge is 1 metre throughout, double-tracked between Bilbao and Las Arenas, and single-tracked between Las Arenas and Plencia. Between Bilbao and Algorta situated between Las Arenas and Plencit, rails 7.6 and 8 metres in length, weighing 30 kg. per metre, and between Algorta and Plencit rails 9 metres in length weighing 22 kg. per metre, are used.

Another electrically-operated line, the Corunna-Sada, at present consisting of 11.4 miles of track, is to be extended to Betanzos, thus completing the distance to a total of 18.64 miles. The owners propose to run their service every 24 minutes to El Carbarro, situated halfway, and every 62 minutes to Sada, the line being divided into various zones. It is believed that the construction of this inter-urban track will mark the beginning of an important era of street railway construction in the district, where a line is considered necessary both for the accommodation of the large passenger traffic and for the furtherance of commercial intercourse between the various industrial centres of the province of Corunna. By the time these lines appear in print the enterprise should be nearing realisation, since one of the largest capitalists of Galicia, associated with an

engineer who is also an enthusiastic promoter of the Corunna-Santiago electric line, has become possessed of an important waterfall near Santander for the erection of the power station to supply the necessary current.

Apart from the favourable market offered by Spain to-day for electrically-driven rolling stock, the country offers an important market for most kinds of electrical goods. As will be seen, there will be a constantly increasing use of power; and as the people become more familiar with the benefits and conveniences of electrical devices, a greatly augmented demand for all kinds of equipment is confidently expected. Although the present exchange rates are slightly unfavourable to Spain (and correspondingly advantageous to us), there is very little doubt that British electrical goods would be welcomed on account of the high reputation which they enjoy throughout the Iberian Peninsula, as, indeed, in all parts of the world. The proximity of Spain to our markets renders this opportunity still more attractive. Quite recently an important opportunity presented itself in connection with the supply of 16 electric cranes required by the Seville Board of Harbour Works. While British manufacturers of these machines were duly notified, through the energies of the Commercial Secretary to the British Embassy at Madrid, the information came rather too late to be of very much value, inasmuch as both German and United States manufacturers had gained knowledge of the opening, and were quickly on the spot, although no tenders had at that time been called for.

The recent imposition of drastic import and export taxes upon machinery and equipment, among other articles of almost every description, may, on the other hand, have a deterrent effect upon the prosecution of further British enterprise. The wisdom of this new legislation is questioned alike in Spain and abroad, and it is not improbable that the pressure of commercial interests may result in a considerable modification of the decree. Similar observations apply to a Royal Decree, issued in June last, modifying the application of a previous law of June, 1879, regarding concessions for the exploitation of hydro-electric power and industrial uses of water. The new decree, which consists of seven clauses, too lengthy to allow of reproduction in these columns, should be studied with close attention by foreign contractors who propose to associate themselves with Spanish hydro-electric enterprises. While the new ordinance will not affect the exploitation of hydro-electric energy now in force, the terms will apply to these installations should they be in any way modified or amplified in the future. One of the most important clauses is the compulsory purchase of all materials and machinery in Spain or of Spanish production, or machinery made exclusively of Spanish materials. A clause covering these regulations will be introduced into all contracts for the future, including concessions now pending.

UNEMPLOYMENT AND THE CURE.

Mr. Arthur Neal, Parliamentary Secretary to the Ministry of Transport, recently stated that the cure for unemployment was the restoration of our industries. Stated in that way, it amounts to nothing more than a platitude, as obvious as that the cure for a cold is to get rid of it.

Nevertheless, it is evident that if our industries were restored there would be a great diminution of unemployment, and the long-run cure for the present situation lies in the revival of trade. In the different stages of acuteness of a disease, various measures become necessary, and unemployment is a disease of industry. There are preventive measures which are suitable for use when the patient is in perfect health. When there is no unemployment, as was the case a couple of years ago, it is possible to refrain from meddlesome interference in the form of control. It is possible to undertake constructive measures whereby trade can be encouraged, instead of destructive measures which upset the normal flow of business. Workpeople ought in such circumstances to keep level heads, and not to listen to the agitator who destroys prosperity by forcing strikes. Wholesome, natural work—that is the best preventive medicine for unemployment, as it is for most physical ills.

When the patient is ill, steps must be taken to cure him, to build up his constitution so that the disease may be thrown off, and that he may be the better able to resist its onset on another occasion. The eventual cure for unemployment being the revival of trade, it follows that it is necessary, in fact vital, to do everything possible to obtain and encourage business. Obstructions to the natural flow of trade must be removed, and new channels must be provided. The work of selling must be energetically carried on, and helped, not hindered, in every way that can be devised. The fatuity of that type of anti-waste that seeks to economise by reducing the selling price, is manifest.

Profitable trading is carried on when the sale price is such as to exceed the cost of production, while not exceeding the value in use. The value in use, or demand value, is what the customer is prepared to pay for the goods. If the price asked is in excess of that of a reasonably efficient substitute, the customer will be inclined to make use of the substitute. The conception of ability to pay, which underlies, among other things, the income tax, the rates, and doctors' bills, plays its part here, and when the exchange runs riot, and it is not possible to think consecutively for two days together in any two currencies, it is necessary to have recourse to methods which have been considered unnecessary for a very long time, such as barter and the exchange of commodities, so that the poorer party may be enabled to buy, and the richer may not run risks. By the poorer party we mean the country against whom the exchange is said to operate, such as Germany, and by the richer, the country in whose favour the exchange is said to operate, such as Great Britain or America.

Costs of production, then, must be kept low. Wages must be so proportioned to output as to help, and not to impede, production. Output must be so proportioned to overhead charges that the amount to be borne by the product is not such as to prejudice sales. Economy must be practised, and ca' canny must go, once and for all. Profits need hardly be mentioned at the present time. We believe all manufacturers are prepared to forego profits in order to keep their shops and workpeople employed, and a glance at the stock exchange prices will show immediately to what an unprecedentedly large extent this policy is being carried out.

The value to the user must be kept high. He must be satisfied with his bargain, in order that he may be induced to place more business. The time of delivery must be short. If, then, we have a cheap, good article, obtainable quickly, the main difficulties in the way of selling are removed; but it must not be supposed that this is the end of the story. It is good, so far as it goes, but it is not enough. The customer must be found, the advantages of using the article must be explained to him, his goodwill must be created, and, when created, maintained. This is the work of a selling organisation. No doubt we have all come across manufacturing men and designers who have expressed views which may be summarised as that when plenty of work is coming in salesmen are not needed, and when there is nothing doing it is because the selling men cannot get business. The truth is, of course, that co-operation between all parties concerned is essential, and that does not mean that they are to co-operate by doing what one of them

decrees. In times of depression the salesman must take more pains than ever to keep in close touch with the customer. The salesman is the ambassador of his firm, and ambassadors have similar duties in creating and maintaining a friendly atmosphere in international matters. If this is done well, then as soon as the customer sees the least chance of placing business, he will place it.

For the purpose of overcoming exchange difficulties, barter is one means, the use of which could be considerably extended. There is in existence, however, an Act of Parliament which was intended to encourage and facilitate export business by enabling the Board of Trade to grant credits for that purpose. This is the Overseas (Credits and Insurance) Act, 1920, and it was amended and extended by Parliament during the present year. The Board of Trade was authorised to grant credits not exceeding £26,000,000 at any one time. The money was to be available for guaranteeing drafts against shipments to all parts of the British Empire and to certain countries named in the schedule. The Board was empowered to make new guarantees up to September 8th, 1922, to renew old guarantees up to September 8th, 1924, and all guarantees were to be terminated by the same date in 1925.

The Board of Trade issued, on October 14th last, a return showing that advances were made, during the three months ending September 30th, 1921, to the extent of £316,661. This total is in respect of Finland, the Baltic Provinces, Poland, Czecho-Slovakia, Jugo-Slavia, Rumania, Bulgaria, and Austria. The total for these countries over two years amounts to £1,276,030. Applications sanctioned but not actually made amount in the quarter to £63,646, and in the two years to £2,706,381. The guarantees given during the quarter, covering transactions with Australia, New Zealand, Cyprus, Rumania, Jugo-Slavia, and Hungary, come to £43,962; and sanction was given to other guarantees totalling £221,672. The sum of all the totals amounts to £4,248,042, or less than a sixth of the amount sanctioned by Parliament. Either those who prepared the memorandum of expenditure likely to be incurred when the Bill was before the House of Commons must have greatly over-estimated the requirements, or the plan is not being pushed as it should be; we incline to the belief that the latter is the case. Possibly if the same patience and ingenuity that discerns in a doll's eye a menace to British trade were devoted to the use of means already in existence for the furtherance of that trade, we might hope, in time, to get somewhere.

The subject of the revival of trade, considered as a curative measure for unemployment, has left us insufficient space to do more than mention the necessity when the disease is at a crisis, and the state of the patient immediately dangerous, of applying palliative treatment. No revival in trade can prevent the necessity of providing work or maintenance for the unemployed during the coming winter, on a scale previously unknown. Suggestions, varying in value, are offered on all hands, but the fact is that relief works are generally uneconomical, and doles are definitely demoralising. The problem seems to resolve itself into the choice of the least of a number of evils.

The measures proposed on October 19th by the Prime Minister in the House of Commons are necessarily of a palliative character, but they seem to contain the seeds of improvements which should grow permanently. The most important suggestion is that of the assistance of public enterprises by the guaranteeing of the payment of principal or interest. The other measures are: Relief works, in the form of afforestation and the reclamation of land; the assistance of emigration; the extension and improvement of the export credits scheme, with which we have dealt above; loans for Guardians in the poorer areas; and the establishment for six months of a contributory fund for the dependents of unemployed workers.

Since the chief difficulty of buying and of manufacturing nowadays is of a financial nature, we regard the proposal to guarantee loans up to a total value of £25,000,000 as likely to be the most helpful, as it is the most novel, of them all. *The Manchester Guardian*, in its leading article on the day following Mr. Lloyd George's speech, asks if we can assume that the money in the hands of a railway company will provide more employment than it would have done in the hands of individuals with whom it would otherwise have remained? Quite simply, yes! It is true that if, by artificial assistance, the carrying on of an industry is rendered more easy than is the case when no assistance is rendered, there is a tendency for capital to be diverted from uses which would normally be more profitable, in order to employ it in the assisted industry. But there are industries and industries, and if a leading economist can openly advocate a subsidy for the purpose of cheapening coal, then surely the transport industry, to take the *Guardian's* own example, being of equal importance, can legitimately be assisted by a financial guarantee. Moreover, if the money, by remaining in the hands of those to whom it now belongs, will provide employment, why isn't it doing so? The answer is, because it is not, and cannot be, properly applied to that purpose while it remains scattered, but it can be so applied when it is concentrated on the object to be attained. There will be difficulties in the application of the scheme. We have shown that there are evidently difficulties in the way of the export credits scheme. They must be overcome. An expert financial committee will be appointed to advise the Government, and we venture to express the hope that room will be found upon it for Mr. McKenna. The speech of Mr. Llewellyn Atkinson at the B.E.A.M.A. dinner on October 20th was the speech of a genius, and such men as he could be more helpful in the revival of trade and the general advancement of industry than the somewhat one-sided committees that have from time to time been created by the Government to deal with other matters.

If the revival of industry is to be achieved in the minimum time, all must co-operate to that end. The question of wage reduction has already received considerable attention, as have the closely allied questions of efficiency and the use of the most modern plant, for instance, in coal extraction. Lord Weir, addressing the British Engineers' Association on October 19th, made some very pertinent observations on the network of restrictive regulations that has been spun about industry by the trade unions. There is no freedom for the individual worker to-day. He has to do as he is told. His union rules him more absolutely than did ever his employer. But Motley has noted that "in all human history the vivifying becomes the dissolving principle," and the history of trade unionism provides no exception. The principle of collective action, once so necessary, has brought in its train restrictions which bid fair to hamper, if not to destroy, the very means of livelihood of employers and workers alike. The frank discussion of these restrictions would, Lord Weir believes, have the effect of reducing costs of production, while permitting wages, and consequently purchasing power, to remain unchanged. We all have one great end before us, and must work together to achieve it. What is wanted, more than anything else, is the common will to serve the common weal.

Electric Ploughs in Petrograd.—The Petrograd metallurgical factories are delivering this month (October) the second parcel of electric ploughs made by them. The number to be ready by March 1st, 1922, is 50.

The Curative Powers of Radium.—Sir Thomas Parkinson, an eminent surgeon, recently gave it as his opinion that radium as a curative agent was a failure. Not only was it ineffective as a remedy, but its burning effects often aggravated instead of curing. Several authorities upon the subject, among them being Prof. Lazarus-Barlow, do not agree with this view. Prof. Lazarus-Barlow, who is head of the Middlesex Hospital Cancer Research Laboratories, believes that radium and X-rays will one day be recognised as more effective than the knife, and will be found efficacious in checking the growth of cancer.

ELECTRICITY SUPPLY IN THE UNITED KINGDOM.

REPORT OF THE ELECTRICITY COMMISSIONERS.

The first annual report of the Electricity Commissioners was issued last week, as mentioned in our pages (H.M. Stationery Office, price 3s. net). It embraces the period from January 31st, 1920, to March 31st, 1921, and comprises 102 pages, with a coloured map showing the approximate boundaries of the Electricity Districts provisionally determined up to March 31st.

The report commences with a review of the position of electricity supply in this country prior to the enactment of the Electricity (Supply) Act, 1919, and the events leading up to the passing of the Act. It is noted that up to the outbreak of war, the largest output in any one year from the whole of the British power stations (about 500) was some 2,000 million kWh; the total capital invested in public supply undertakings up to the year 1916 was approximately £91,000,000, of which local authority undertakings accounted for £55,000,000 and company undertakings for £36,900,000 (including £10,000,000 expended by power companies under special Acts).

During the war the electrical output from public supply stations more than doubled, amounting to 4,628 million kWh in 1918. It was recognised to an increasing extent that an abundant supply of cheap power was almost as essential as labour and materials for rapid and economical production in all forms of industry.

The report states that the general position at the end of the year 1918 with regard to the *generation* of electricity for public supply purposes other than traction is illustrated by the figures given in Table I.

Table 1.—Generation of Electricity in United Kingdom.
(Approximate position at December 31st, 1918.)

Undertakings.		Generating plant installed.	Capital expended on lands, buildings, sidings, wharves, &c., and generating plant, *excluding* distribution items.	
Class.	Number.		Total.	Average per kW. installed.
		kW.	£	£
Local Authorities.				
London	11	131,791	3,375,396	25·6
Rest of Great Britain	214	1,259,133	26,312,862	20·3
Ireland	11	28,695	624,853	21·8
Total	239	1,419,619	30,313,111	20·9
Companies.				
London	15	216,037	6,282,071	29·1
Rest of Great Britain	162	135,645	4,310,586	31·8
Ireland	5	2,801	128,428	45·9
Total	182	354,483	10,721,085	30·2
Power Companies.	17	370,053	7,258,840	19·6
Totals	438	2,175,155	48,293,036	22·2

On March 31st, 1921, the staff of the Electricity Commission consisted of 19 established officers and 23 temporary officers (including typists, messengers, &c.), numbering 42 in all.

The Commissioners' estimate of their receipts and expenditure in respect of the period ending March 31st, 1921, showed an excess of estimated expenditure over estimated receipts amounting to £43,550. The actual excess of expenditure over income for the period, including amounts outstanding on March 31st, 1921, was £40,958. A comparison under main heads of the estimated and actual expenditure and receipts is given in Table 2, and a detailed statement of expenditure and receipts is set out in an appendix.

The amount actually advanced out of moneys provided by Parliament to meet payments by the Commissioners during the period was £34,901.

Reorganisation of Electricity Supply.—As there already exists an extensive and heterogeneous development representing the unco-ordinated growth of many years, the problem of reorganisation resolves itself into the determination of the best method of adapting, modifying and expanding the existing development with the view of ensuring as speedily as possible an improvement in the supply of electricity. The Commissioners point out that progress can only be gradual; even if the problem could be reduced to engineering considerations alone, the present financial stress would constitute a barrier to the speedy development of schemes. They are, however, confronted with a problem of a much more difficult and complex character.

It is only after thorough investigation at all stages, with the fullest opportunity afforded to all interested parties to make representations at each stage, that a scheme for the reorganisation of supply in any district can become of statutory effect through the medium of an Order of the Commissioners, confirmed by the Minister of Transport and approved by Parliament. Even in the most favourable circumstances, it is apparent that considerable time must elapse between the provisional determination of a district and the approval by Parliament of a scheme for the district.

Table 2.—Expenses of Electricity Commissioners.
(From date of appointment to March 31st, 1921.)

Items.	Estimate. £	Actual. £
Expenditure.		
(i) Salaries and remuneration of Commissioners and staff	36,000	35,876
(ii) Other expenses of administration (less amounts recovered)	7,250	5,232
(iii) Interest on advances from H.M. Exchequer	800	970
Total	44,050	42,078
Receipts.		
Fees for Special Orders, &c.	500	1,120
Excess of expenditure over receipts ...	43,550	40,958

As soon as possible after their appointment, the Commissioners made a preliminary survey of the present and prospective electrical requirements of a considerable portion of the country, which has served to emphasise:—

(*a*) The wastefulness and inefficiency of the present organisation for the supply of electricity;

(*b*) The urgent need for co-ordination among the existing supply authorities; and

(*c*) The advantages in conservation of capital and of coal and in increased efficiency to be derived from joint action.

The Commissioners came to the conclusion that the existing organisation for the supply of electricity in a number of districts should be improved, and published Notices of Provisional Determination of 13 districts. The titles and approximate areas of the districts are given in an appendix, together with a map of England and Wales showing the approximate boundaries of the 13 electricity districts so far provisionally determined.* The Commissioners have also made preliminary surveys of other portions of England and of certain districts in Scotland, and at the date of this report had under consideration the question of provisionally determining further districts.

With the view of assisting the promoters of schemes, the Commissioners issued a memorandum indicating in broad outline the main headings under which proposals for the reorganisation of supply and for the setting-up of a Joint Electricity Authority should be formulated; this is reproduced as an appendix to the report.

Up to March 31st, 1921, schemes had been submitted to the Commissioners in respect of five districts, and in three cases the Commissioners had held local inquiries.

In respect of the Lower Severn Electricity District, a scheme was submitted to the Commissioners by an Organising Committee, and the Local Inquiry was commenced at Bristol on January 11th, 1921,, but the Commissioners found it necessary to adjourn the Inquiry, owing to the fact that particulars were not generally available to all interested parties, and also on account of certain difficulties of procedure. The scheme was lodged prior to the issue by the Commissioners of their memorandum for the guidance of the promoters of schemes, and the Organising Committee, in its pioneer efforts towards the framing of the first concrete proposals for the constitution of the new Joint Electricity Authority contemplated by the Act of 1919, had been faced with many difficulties, and had no precedent to guide it. Eventually the scheme was not proceeded with by the Organising Committee.

In respect of the Mersey and West Lancashire Electricity District, two schemes were deposited with the Commissioners The Local Inquiry was commenced at Liverpool on January 25th, and adjourned on January 29th; it was resumed on March 8th, and brought to a conclusion on March 10th.†

In respect of the North Wales and Chester Electricity District, two schemes were submitted; the Local Inquiry was

*A map showing these districts, as then determined, was published in the Electrical Review of January 7th, 1921.

† A communication embodying the conclusions and decisions of the Commissioners was issued to all the interested parties on April 19th, 1921. (See Electrical Review, April 22nd, p. 513.)

commenced at Llandudno on February 15th, and ended on February 22nd.*

In respect of the West Riding (Aire and Calder) Electricity District, two schemes were lodged, and a local Inquiry was to have been held at Leeds on April 12th, but was deferred to May 18th.

In respect of the London and Home Counties Electricity District, six schemes were lodged, and the Local Inquiry was opened on June 14th.

With the object, primarily, of keeping the costs of Local Inquiries within reasonable limits, the Commissioners issued a memorandum in December, 1920, drawing attention to the desirability of securing as large a measure of agreement as possible prior to an Inquiry, pointing out that separate representation of parties by counsel or otherwise appeared to be unnecessary unless the interests of such parties were divergent, and referring to the extent to which witnesses should ordinarily be necessary, and the necessity for avoiding duplication of evidence. It was also pointed out that when a scheme had been approved by the Commissioners as the result of a Local Inquiry, the proceedings at the further Local Inquiry should ordinarily be more or less formal. They have decided to publish a draft Order embodying the decisions arrived at as the result of the principal Inquiry, and to invite observations upon its clauses before holding the further Inquiry.

Generating Stations and Main Transmission Lines.—Before establishing a new, or extending an existing generating station or main transmission line, it is necessary to obtain the consent of the Commissioners thereto. In dealing with applications, the Commissioners have followed a policy which has been governed by the following broad considerations:—

(*a*) The necessity for facilitating the development of electricity supply in any district and for avoiding any sterilisation during the period between the enactment of the Act of 1919 and the coming into operation of a scheme for the reorganisation of supply.

(*b*) The effect of the establishment of any new station, or of any extension of an existing station, upon the ultimate development of supply in the district concerned.

(*c*) The undesirability of extending a badly placed station in one district when a better situated station in the same or an adjacent district could be extended and thus enabled to assist the first-named station.

(*d*) The necessity for avoiding the extension or establishment of small and uneconomical stations in cases where the balance of advantage was in favour of taking a bulk supply from an alternative source.

Before consent was given in any case the Commissioners required to be satisfied that the need for the new station or additional plant was urgent; that the proposals were technically and financially sound; and that there was no economical alternative source of supply available either at the moment, or in the immediate future. In some cases they found there was no alternative but to consent to the extension of badly placed and uneconomical stations, in order that there might be no shortage of supply pending the formulation and bringing into effect of a general scheme of improvement for the district. In other cases, however, it was found possible, as the result of negotiations and of pressure brought to bear by the Commissioners, for undertakers to obtain a bulk supply on terms at least as favourable as, or even more favourable than, the resultant costs involved in a proposed local extension, and thus to obviate the enlargement of certain small and uneconomical stations.

A number of important applications relating to the establishment of new generating stations were dealt with during the period ended March 31st, 1921.

The Corporation of Belfast was authorised to construct a temporary generating station at Messrs. Harland & Wolff's shipyard, Belfast, pending the completion of the new harbour power station which was authorised by the Board of Trade in 1918; two 6,000-kW sets ultimately intended for the new power house were installed.

The Corporation of Leicester was authorised to construct a station to contain initially 20,000 kW of generating plant, with the possibility of ultimate extension to meet a demand of 50,000 kW.

The Corporation of Manchester had powers to construct a generating station on a site at Barton, and commenced the erection of the first section of a station to contain two 25,000-kW turbo-alternators, the site permitting of ultimate extension to 150,000 kW. At the instance of the Commissioners, the Corporation agreed to increase the capacity of the first section by installing a third 25,000-kW set, with the object of meeting as speedily as possible the urgent requirements of other authorised undertakers in the district.

The Corporation of Nottingham applied to the Commissioners for consent to construct on a site at Clifton a station to contain 40,000 kW of generating plant with the possibility of ultimate extension to 240,000 kW or more. Concurrently, an application was received from the Derbyshire and Nottinghamshire Electric Power Company for consent to construct on a site at Colwick a station to contain initially 30,000 kW of plant with the possibility of ultimate extension to 120,000 kW. An Inquiry was held at Nottingham on July 21st and 22nd, 1920, and the Commissioners issued a formal consent in respect of the application of the Corporation and refused the application of the Company.

The Commissioners subsequently issued a consent to the construction by the Corporation of a temporary generating station on the Clifton site to contain 4,000 kW of generating plant to meet the demands for electricity pending the construction of the permanent station.

The Corporation of Salford applied for consent to construct, on a site at Agecroft, a station to contain initially 45,000 kW of generating plant, with the possibility of ultimate extension to 120,000 kW. A decision had not been arrived at by March 31st.

The County of London Electric Supply Co., Ltd., had been authorised to erect a generating station on a site at Barking, and applied to the Commissioners for consent to erect a station to contain initially three 33,000-kW turbo-alternators with the possibility of extension. The Commissioners held a Local Inquiry on October 6th, 1920, and following days. After consideration of the evidence they reserved their decision.

The Portrush Urban District Council was authorised to erect a station of 66 kW.

The West Kent Electric Co., Ltd., and the Yorkshire Electric Power Co. also lodged applications, on which decisions were reserved.

The Commissioners issued consents to the establishment of new generating stations by the following non-statutory undertakings:—

East Anglian Electricity, Ltd. (Felixstowe).—A generating station at Sudbury to contain plant of 264 kW.

E. C. Gates, Ltd. (Norwich).—A generating station at Stalham to contain plant of 4 to 6 kW.

Tullamore Electric Light & Power Co., Ltd.—A generating station at Tullamore to contain plant of 200 kW.

From the foregoing it will be seen that the Commissioners issued consents to five authorised undertakers and to three non-statutory undertakings in respect of new generating stations, representing plant of 150,000 kW with the possibility of ultimate extension to a much larger figure. Further applications were under consideration on March 31st.

The Commissioners dealt with applications from some 120 authorised undertakers and from four tramway and railway authorities for consent to the extension of existing generating stations. They came to the conclusion that only such additions to, or modifications of, generating stations as involved an increase in rated capacity of generating plant constituted extensions requiring their approval. A complete list of consents issued up to March 31st, 1921, is given in an appendix. The sanctioned extensions represent plant of approximately 547,000 kW. Of this total, approximately 415,000 kW was in respect of local authority undertakings and approximately 113,000 kW in respect of company undertakings, the remainder (18,740 kW) being in respect of tramway and railway generating stations.

The Commissioners prescribed or approved the type of current, frequency, and pressure to be used at new private generating stations proposed to be established by 10 owners.

A number of applications relating to the establishment of main transmission lines were made to the Commissioners, and in some cases the necessary negotiations and formalities had not been completed by March 31st, 1921. Formal consents have been issued, however, in the four following cases:—

Corporation of Edinburgh.—6,600-volt main transmission lines from the Westbank Power Station, Portobello, to McDonald Road, Dewar Place, and Cowgate.

Metropolitan Borough Council of Woolwich and Urban District Council of Erith.—33,000-volt main transmission line from the generating station at Globe Lane to the generating station at Erith.

North Metropolitan Electric Power Supply Co.—A main transmission line, to be used initially at a pressure of 10,000 volts, and subsequently, if found necessary, at a pressure of 20,000 volts, between the generating stations of the company at St. Albans and Hertford respectively.

(To be concluded.)

* A communication embodying the conclusions and decisions of the Commissioners was issued to all interested parties on April 22nd, 1921. (See Electrical Review, April 29th, p. 571.)

Russian Electrical Industry.—A general review of Russian industry based on material supplied to the Russian Official Economic Journal, *Ekonomiteskaya Zhism*, referring to the electrical industry in the first quarter of 1921, says that the number of workers engaged in the principal factories in that period had risen from 6,708 to 7,668, or by 14 per cent., whilst other employés had increased in number by 7 per cent.; but the increase in the number of workmen did not result in a corresponding output of goods, which partly negative result was due to the lack of skill on their part, which was particularly shown in the quality of the work. Compared with the last quarter of 1920, no improvement is reported. The output in some factories increased; in others it decreased. The principal causes of the continuous unsatisfactory industrial output are again said to be the poor supply of fuel and the food crisis, which for many months now have been a leading feature in the economic situation at Kharkoff and Petrograd.

THE COST OF LIVING IN CHINA.

In our issue of June 3rd, 1921, we published a letter in which tabulated details regarding the cost of living in Burma were given. The British Chamber of Commerce *Journal*, Shanghai, had in its issue of July, 1919, published an article on the cost of living in that city, and on seeing the table above-mentioned (which it reproduces, but attributes accidentally to a non-existent *Electrical Engineer*) it was led to publish similar tables for Shanghai, Tientsin, and Hong-Kong in the issue for August, 1921. It points out that, whilst there are free furnished houses in Shanghai and Hong-Kong, they are the exception and not the rule. The first column in the Burma table has not, therefore, been included in the Shanghai or Hong-Kong figures.

The Cost of Living in Shanghai.

Item.	Young bachelor.			Young married couple.		
	Sharing rented mess with two others	Boarding house.	Hotel.	Rented house.	Boarding house.	Hotel.
	Mex. $.	Mex. $.	Mex. $.	Mex. $.	Mex. $.	Mex. $.
1. House rent and taxes	46	150	300	198	250	540
2. Food	50			120		
3. Sodas, wines, beer, &c.	15	15	15	20	20	20
4. Tobacco, papers, &c.	8	8	8	8	8	8
5. Lighting	4	—	—	10	—	—
6. Guests	10	10	15	20	15	20
7. Amusements	20	20	20	20	20	20
8. Club bills	25	25	25	25	25	25
9. Clothes, shoes, hats, &c.	25	25	25	75	75	75
10. Laundry	7	5	5	15	9	9
11. Furniture, &c	8	—	—	25	—	—
12. Car and chauffeur	—	—	—	100	100	100
13. Gary or motor cycle	40	40	40	–	—	—
14. Insurance	25	25	25	25	25	25
15. Servants	21	5	5	64	6	6
Total in Mex. $	304	328	483	655	553	848
Totals in sterling at rate of exchange at time of writing, £1 = Mex. $7.64	£39 15 10	£42 18 7	£63 4 4	£85 14 7	£72 7 7	£111 0 0
Add items required in Shanghai not included above.						
1. Telephone	2	—	—	5	—	—
2. Fuel: Heating and cooking	10	5	5	30	10	10
3. Medical attendance, prescriptions, toilet articles &c.	5	5	5	16	16	16
4. 5% for contingencies	16	17	25	35	29	44
Mex. $	33	27	35	86	55	70
Total Shanghai, Mex. $	337	355	518	741	608	918
Totals in sterling at rate of exchange at time of writing. £1 = Mex. $7.64	£44 2 2	£46 9 2	£67 16 0	£97 0 0	£79 11 7	£120 3 0

Totals in sterling at present rate of exchange: –

Burma: 1 rupee = 1s. 8d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
	30	5	5	30	11	11½	34	16	7	79	17	7½	63	16	0½	73	4	10½
Tientsin: £1 = Mex. $7.64.	47	7	7	42	16	0	48	8	1	102	17	7	88	19		102	14	9
Hong-Kong: £1 = Mex. $7.64	37	0	10	40	6	3	60	5	10	78	0	1	67	0	3	105	15	2

Similar figures apply to Tientsin, but roughly speaking they are 50 per cent. higher than in Burma; they are somewhat higher than in Shanghai, except in the case of hotels, which are cheaper. For the sake of comparison, we reproduce the totals in each case.

The Hong-Kong figures are practically a repetition of the Shanghai figures. There are very few motor cars in Hong-Kong, and ownership is the exception rather than the rule. The additional items added to the Shanghai list would apply equally to Hong-Kong.

Further detailed figures for Shanghai are given in the same *Journal* for September.

Working Hours, Management, and Profit Sharing.—The International Building Trades Conference at its sitting at Brussels on October 21st expressed a desire to see the suspension of the application of the eight hours law in countries where it is in force, and a postponement of its application where it is not, until the complete re-establishment of the international situation. The Conference was also unanimous in considering the participation of labour in the management of business as absolutely incompatible with conditions of enterprise, and it also declared itself definitely opposed to the obligation to give labour a share in profits.—*Reuter.*

THE BRITISH ELECTRICAL AND ALLIED MANUFACTURERS' ASSOCIATION (INC.).

Annual Dinner.

On Thursday last week the annual dinner of the "Beama" was held at the Savoy Hotel; the Right Hon. Lord Ampthill, G.C.S.I., G.C.I.E., president, was in the chair, and there was a large attendance of members and guests, numbering some 500. Amongst those present were Lord Carmichael, G.C.S.I., Lord Meston, K.C.S.I., Lord Vaux of Harrowden, Sir James Devonshire, Sir Charles Parsons, Sir H. Frank Heath, Sir C. Ellis, Sir James D. Connolly, Sir John Aspinall, Sir Edgar Walton, Sir William Diamond, Brig.-Gen. Sir H. W. Thornton, K.B.E., Sir W. Noble, Sir J. E. Petavel, Sir Timothy Coghlan, Lt.-Col. Hon. P. Pelletier, Lt.-Col. F. A. Cortez Leigh, Hon. J. McEwan Hunter, Mr. J. C. Gould, M.P., Mr. George Balfour, M.P., Mr. W. O. Smith, Mr. J. S. Highfield, Mr. H. Hirst, Mr. John Taylor, Mr. Ll. B. Atkinson, Mr. H. C. Levis, Mr. Gerard Swope, Mr. F. C. Wade, Mr. John Howard, Mr. J. B. Whiting, Mr. W. St. D. Jenkins, Mr. J. A. Corcoran, Mr. A. H. Ashbolt, Mr. M. J. Railing, Mr. B. Longbottom, Mr. A. E. Tanner, Mr. E. S. New, Mr. A. F. Berry, Mr. F. H. Nalder, Mr. A. P. Wood, Mr. F. C. Gibbons, Mr. D. N. Dunlop (director and secretary), and many other well-known men.

After the Chairman had proposed "The King," Mr. George Balfour gave "The Industry," regretting the absence of Sir Gordon Hewitt, Attorney-General, who was to have had charge of the toast. Up to the outbreak of war, he said, the electrical industry was backed up by capital, enthusiasm, and sacrifice, and there seemed nothing wanting to make the industry a success—but foreign competition, establishing works and agents throughout the country, designedly so depressed prices that it was impossible to secure the reward of their labours. Those tactics were about to be renewed; but they would face their difficulties with courage, if given a reasonable chance. That young Association could claim fully to represent the electrical industry of this country, and many of the allied trades, touching as it did every branch of industry. Its activities were of the utmost importance not only to the electrical industry, but to the general commerce of the country. As the Prime Minister had just said, the cure of unemployment rested not with the Government but with industry; they could do it, if their pre-war freedom were restored. The main necessity was a readjustment of wages on an economic basis, in order to reduce unemployment. Lord Weir had struck the right note, and he asked them to preach the doctrine of reduction of wages so as to fill the workshops, even if no profits were made.

Responding to the toast, Mr. Ll. B. Atkinson outlined the events of the past twelve months, resulting in the collapse of industry. They were all calling on the Government to "do something," but it was for the industries to get themselves right, and the Government could only play a small part in the process. The engineering and metal trades were the worst hit; they relied almost entirely on the construction of reproductive works, which depended on the existence of a surplus of production of food and clothing, and they could only be fully employed when that surplus was created. Relief works would not solve the problem, and export credits were useless to the electrical industry, for its products took 20 years to repay their cost. There could be no re-establishment of our industries until the nation was able to make savings. The demoralisation of the German exchange was really due to the liquidation of a bankrupt stock; even the Germans had now become aware that the mark was worthless, and the time was approaching when people in Germany would not accept payment in paper marks. The Germans, however, were working twice as long for a pound of bread as the Belgians or English, and those who did the most work for a pound of bread would secure the world's trade. There must be a readjustment of wages per unit of output; either works would have to close, or workmen would have to realise that the output per unit of wage must increase, and work longer hours until stability returned. Much could be done by discussion with the authorised representatives of labour; he had great faith in industrial councils, which had been very successful in the cable-making industry. It was useless to look to the Government; they must solve their own problem, and face the facts, however disagreeable they were.

The Chairman, proposing "Our Guests," said the objects of the Association were essentially national and patriotic; no one in business could be without a sense of responsiblity to the country, or fail to recognise that our national existence depended upon the prosperity of industry. Paying a tribute to the war service of Brig.-Gen. Sir H. W. Thornton, in connection with the management of the Great Eastern Railway, the chairman coupled his name with the toast.

Responding, Sir Henry Thornton made a humorous speech, but said the foundation of all economic wages was that the employer should pay the worker a wage which would enable him to bring up his family in decency and comfort, and more if possible. The railway managers had no quarrel with the present scale of wages, provided that a corresponding production was given; nor did they object to the 8-hour day, if they got eight hours of honest reasonable toil. What they wanted was production. The great railway groups that

had been formed were closely connected with the electrical industry; the directors had a keen sense of their responsibility to the nation, and knew that unless they rendered a satisfactory account of their stewardship the alternative was nationalisation—a course which never tended to the welfare of the public. The responsible labour leaders of this country were convinced that production must be increased, and that the wages paid must be in proportion to the output. Railway managers were agreed that before industry could prosper, rates and fares must be reduced; the present high charges were but a temporary expedient. He hoped that in the coming months they would be able to join hands with the great captains of industry and the responsible leaders of Trade Unions in an endeavour to restore the country to its pre-eminent position.

An excellent entertainment was provided by the Westminster Abbey Quartette, Miss Olga Haley, and Mr. Sterndale Bennett, and the function was exceptionally successful and enjoyable, the proceedings lasting to a late hour.

LEGAL.

Lobito, Benguella & Catumbella Electric Light and Power Co., Ltd.

An application was made to Mr. Justice Astbury in the Chancery Division on October 19th by Mr. Charles Wreford Brown to be allowed to rank as a holder of £1,000 mortgage debenture stock, 1916, in the above company, which was formed to supply electric light and power to the towns named, which are in the Portuguese Colony of Angola, and to develop and accumulate electrical power at the falls of the Catumbella river. The matter arose in a debenture holder's action against the company. Counsel for the applicant said the Master of the Court had disallowed the debenture. The writ in the action and notice of motion for a receiver of the company was served on June 26th, 1919, and a receiver was appointed on July 11th. Mr. Brown's debenture was signed and sealed, and bore date of July 7th. It was, however, dispatched to him on July 17th.

Mr. Byrne, for the Receiver, said the debenture stock was not issued until after the appointment of the receiver and when the company had ceased to carry on business.

His Lordship: Then the receiver must hand it back.

Counsel for Mr. Brown said it was issued before the appointment of the receiver.

Mr. Byrne said the Master said it would be a fair compromise if this gentleman had his £1,000 back with interest, but not a bonus of 7s. 6d. in the £, which he also claimed under a collateral agreement.

His Lordship thought that was a fair compromise.

All parties agreeing, his Lordship ordered the repayment of £1,000 with interest at 6 per cent., but said the applicant could not have the bonus.

Unemployment Pay.

At the Southport Court, on October 17th, Sydney Brooks (18), electrician's improver, was summoned at the instance of the Ministry of Labour for an alleged breach of the Unemployment Act on July 29th. According to the *Liverpool Post*, Mr. W. H. Watson said defendant signed at the employment exchange as being unemployed from May 20th to July 30th, with the exception of eight days. As a matter of fact, he was employed at night during the whole of the period in connection with the lighting of the Pavilion Theatre, Southport. During most of the time his wages were 25s. a week, and for the remainder 20s. He received 20s. a week unemployment pay up to the beginning of July, and then 15s.

The defence, submitted by Mr. Greenwood, was that a person was entitled to unemployment pay if he only did spare-time work apart from his ordinary occupation, and did not earn more than 3s. 4d. a day or £1 a week, and had been previously doing that kind of spare-time work in addition to his ordinary occupation.

The Law Clerk ruled that the fact of defendant's spare-time work being similar to his ordinary occupation did not matter.

The Bench decided, in view of the importance of the case, to adjourn it until November 2nd.

The Position of a Telegraph Pole.

At Skipton County Court, on Friday, judgment was given for the Postmaster-General in a case in which the postal department wished to erect a telegraph pole near the Friendly Societies' Hall, Sheep Street, Skipton, and Lord Hothfield, owner of the property, disagreed. The Post Office contended that the place was a public highway, within the meaning of the Telegraph Acts 1863 and 1920. The consent of the Skipton District Council had been obtained, but Lord Hothfield seemed to be aggrieved and demanded the removal of the pole. For Lord Hothfield, it was contended that the pole interfered with the amenities of the property, casting a shadow into the Friendly Societies' Hall and the café, and interfering with the privileges of the frontage. It tended to prevent the repairing of the property, and was likely to cause annoyance by youngsters climbing the steps to the hall and sliding down the pole. The respondent wished the pole removed, but if the Court allowed it to stand he asked for an acknowledgment of £1 per year. Judgment for the Postmaster-General was given, with costs on Scale C, and the acknowledgment payment was not allowed.

Action Against the Bradford Corporation.

The Bradford town clerk has reported to the Electricity Committee upon correspondence with a firm of solicitors acting for a well-known Bradford firm of textile merchants, who have served on the Corporation a writ claiming an injunction, damages and costs, arising out of building operations now being carried out by the Corporation on land adjoining the Bolton Road electricity sub-station. After consultation between the town clerk, the chairman of the Committee (Ald. W. Turner), and the city electrical engineer (Mr. Thomas Roles), the Electricity Committee approved the action of the town clerk, and authorised the Corporation officers and a sub-committee of members of the committee to take all necessary steps to defend the proceedings.

Enfield-Ediswan Cable Works, Ltd. *v.* The A. & A. Electrical Co., Ltd.

In the King's Bench Division, on Monday, before Mr. Justice Branson, plaintiffs sued defendants to recover £2,000, balance of account said to be owing for electrical wire sold and delivered for shipment. Alternatively damages for non-acceptance were asked for.

Plaintiffs said that at the end of December, 1919, and the beginning of January, 1920, they agreed to sell defendants 1,000,000 metres single wire 1.5 sq. mm. insulated cable at £8 per 1,000 metres, less 2½ per cent. cash, against documents, including packing for export and delivery f.o.b., according to specifications in defendants' order of December 31st, 1919. Plaintiffs said that at an interview between representatives of the parties in April, 1920, it was verbally agreed that as to 114 cases containing 910,900 metres, value £7,287, plaintiffs should make delivery to defendants' agents at Poole Wharf. This was done, and the defendants had paid £6,000, part of the purchase price, but had not paid the balance for these goods.

Defendants replied that the goods were not fit for their purpose of a contract with Messrs Max Weinberger & Co., and they claimed £1,087 damages for loss of profit.

Mr. Barrington Ward, K.C., and Mr. Cartwright Sharp appeared for the plaintiffs, and Mr. Patrick Hastings, K.C., and Mr. Melville for the defendants.

Opening the plaintiffs' case, Mr. Barrington Ward said the larger part of the property had passed, and there he claimed for price; as to the rest he claimed damages. The dispute related to the ordinary electric cable of commerce, and he suggested that if there had not been a fall in the market price this litigation would never have been begun. The balance of price claimed was £1,287. The price of the 910,900 metres delivered was £7,287, and they had received by arrangement with the defendants' bankers £6,000. They had, packed at their works, another 87,000 metres, for which £696 was claimed; there the Court, he submitted, must look to the difference in price between the contract price and the market price at the date of repudiation. There was a balance of £16 for a remaining 2,000 metres. The defence raised the question of the contract. The defendants said the contract was that the plaintiffs should make this cable in accordance with the standard specification of the Verband Deutscher Elektrotechniker. The plaintiffs said that specification was to apply only in respect of thickness; the defendants that it was to apply in all respects—as to chemical composition as well—and they said the cable was not merchantable. They counterclaimed for the £6,000 and loss of profits on the sub-sale, but loss of profits on a re-sale could not be recovered except on goods sold for the express purpose of fulfilling a particular contract; only the difference was recoverable between the goods as they were and as they should be. With thickness only in question, the defendants tried to place on them an impossible burden by insisting on full accordance with the V.D.E. specification. All through the correspondence the defendants were talking only of thickness. The cable (of which pieces were handed in) was of copper wire surrounded by two layers of vulcanised indiarubber, then tape, and an outer braiding. The defendants in their particulars suggested that the rubber was hard, brittle, and unsuitable, of no elasticity, and poor mechanical quality; that the tape was of poor quality and the braid insufficiently impregnated with black which had not penetrated properly. They said the percentage of rubber was less than it should have been, and its weight was 26.8 per cent., instead of 33⅓; that the percentage weight of resin was 13.8 instead of 6; and of other ingredients including sulphur 73.2 instead of 66.7, as required by V.D.E. They put their loss of profit at £1 1s. 9d. per 1,000 m., or £1,087. The early correspondence was empty of complaints, but strikes were mentioned, with

the proper comment "our domestic difficulties have nothing to do with you."

Counsel added that they were told that strikes at Amsterdam had delayed delivery, and Messrs. Weinberger & Co., their consumers, complaining of quality, had refused the third delivery. He suggested that Weinberger & Co. did not find it convenient to take up the lot. Plaintiffs wrote: "You know the cable is equal to the sample we placed before you." Most of the invoices said "to the thickness of the V.D.E."; some "thin copper conductor V.I.R." or vulcanised india rubber. Defendants contracted to sell to Weinberger & Co. cable "to the thickness of the V.D.E." When plaintiffs' invoices said "to V.D.E." it meant to V.D.E. thickness.

Mr. Albert Victor Downton, technical director to the plaintiffs, said there was a British engineering standard, and the 1910 standard was well known. As to defendants' complaint of the mechanical quality of this cable, he had to say that the Government officials made their bending and elongation tests when they inspected the cable, and this cable passed the tests. All cable became harder, as bread became staler with the lapse of time, especially in a dry storage. All defendants' tabulated complaints were ill-founded, except the statement as to chemical composition. Plaintiffs had supplied £80,000 worth of this cable to the Continent without complaints. The delivery was suitable for general electrical wiring purposes on the Continent. It would not have been possible to supply the cable up to the V.D.E. chemical standard at the price quoted. As it was not according to an English standard, there was no call for it in this country. A sale, if they were able to make a good one, in August, 1920, might have realised £2 10s.; the scrap value of the order was under £1. The Germans had been manufacturing for 50s. The Germans officially reduced in their V.D.E. specification for 1920 the rubber percentage to 20. That was when they were out to capture the market.

Mr. Downton told Mr. Patrick Hastings that the defendants were assured, upon the contract, "the cable will be manufactured in strict accordance with the V.D.E." This was safe for house fixings. The difference between the Continental and English requirements was that here a layer of pure rubber, or a pure separator, was required. That was the difference between the Continental and the English practice, but the quality of the Continental kind would be practically equal. His last report from the Continent was that cable was to be bought there for £2. He supposed, by the rate of exchange, the Germans could supply cheaper than we, but the market was down because people were not requiring cable now.

His Lordship said he had been looking at the percentages in the defendants' table of complaints, and he found they totalled 113.8. That seemed to be exacting a good deal.

Evidence was given of the efficiency to-day of the cable supplied for this order, by Mr. George Dania, M.I.Mech.E., A.M.I.E.E. He had taken several samples of the cable in question, and found all above V.D.E. thickness. It retained its elasticity to a remarkable degree, the braid was properly impregnated, and the cable was open to none of the complaints the defendants brought against it.

Similar evidence was given by Mr. William F. Adams, mechanical and electrical expert, who said the wire was distinctly merchantable.

Mr. Frederick Plutte, of the plaintiffs' firm, said he did not remember that at any interview in May or June, 1920, defendants' Mr. Agazar ever rejected the wire as useless. He said it was not in accord with the V.D.E. specification, but he never said anything against its merchantability. As a matter of fact, it complied in every particular with plaintiffs' undertaking.

Opening defendants' case, on the score of contract, Mr. Patrick Hastings suggested that the parties were never at one. Plaintiffs offered wire insulated with a layer of pure and with vulcanised india rubber. Defendants ordered high-grade vulcanised rubber. "The goods must be in strict accordance with the German V.D.E." they laid down, and no one could say that strict accordance with the British standard specification, for instance, meant accordance with it only in one particular or that V.D.E. did not mean V.D.E.

The first witness for the defence, Mr. Max Weinberger, who spoke by interpreter, stated that when he saw the wire was not in order he sent to the Dutch Government Office and had it tested. He put in the written report, which showed that it was not in accordance with the V.D.E. There was, he discovered, no market for this kind of cable, though had it been in order he could easily have found a market for it.

Cross-examined: What he asked for was wire insulated with high-grade vulcanised india rubber of the thickness of the V.D.E. and of the best quality.

Mr. S. C. Mote, of the India Rubber, Gutta Percha & Telegraph Works Co., Ltd., of Silvertown, stated that for 20 years he was head of the experimental and testing department. The firm employed 5,000 men. High-grade vulcanised india rubber would stretch like a catapult. The rubber in the cable supplied was of low-grade quality, from his point of view.

Electrical evidence was given by Mr. Alfred Morris, B.Sc. (Engineering), London, A.I.E.E., superintendent of the testing department of Faraday House, who said he thought the samples of this cable he examined would let out more electricity than they should.

Mr. Morris said the rubber in the samples of this cable he examined in September and December, 1920, was semi-perished and in a state that good quality rubber ought not to be in after 18 months. Its mechanical properties were poor. The proportion of rubber was 26.4 per cent., 16 per cent. of which was resin. He should expect 5 per cent. in high-grade rubber. The rubber would stretch 1¼ times its length and not five or six times.

Mr. Ward: He should not say the stretching property of cable rubber ought to be as good at that of "electric thread," and to stretch only 1¼ times was unsatisfactory. He agreed that what he found 16 per cent. of resin in was a mixture; not pure rubber. Deterioration would be greater in a dry store. Practically all the electric light cables tested at Faraday House were of vulcanised rubber, and 5 per cent. would be a usual proportion of resin in such vulcanised rubber.

Mr. William Henry George Shipman, manager of defendants' firm at the time of the transaction, said Mr. Flaskett, for the plaintiffs, wrote to him confirming a telephone assurance that the cable would have two layers vulcanised rubber, and would be manufactured in strict accordance with the V.D.E. specification.

Answering Mr. Barrington Ward, witness said the sub-purchaser's order was for copper insulated with high-grade india rubber to the thickness recommended by the V.D.E.

Mr. Berge Reuben Agazar, managing director of the defendant company, said they were agents for the sale of electrical goods. He had no experience before of the sale of cable, and no technical knowledge of cables. They telephoned to make it clear that the V.D.E. specification was being followed. Afterwards he told Mr. Plutte candidly that he thought the first reason for their customer's hesitation to accept was financial, and due to fulness of stock; afterwards he said there were verbal complaints of the cable, and said he had encountered criticism when he offered it to other clients.

Cross-examined: He ascertained that Mr. Weinberger sent the cable to the Dutch Government laboratory, not because of the state of the market, but because his customers had returned his early instalment of the cable to him.

A former director of the defendant company, Mr. Antony de Jong, said Weinberger in Holland complained of the quality of the cable from the time witness showed him the first sample, but witness did not take him seriously. Later Weinberger said the market had become slower, asked that deliveries might be held up till the autumn, and offered jointed conduit on a *contra* account.

Judgment was given for plaintiffs for £1,287 claimed, with costs, with, in addition, payment for the balance at £2, the price fixed by his lordship for the purpose of calculating damages. A stay of execution was granted.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Creda" Bowl Fire.

The Credenda Conduits Co., Ltd., Whitehouse Street, Aston, Birmingham, have recently commenced the manufacture of a new bowl fire. The bowl of the "Creda" fire (fig. 1) is made from spun copper which is mounted by means of a swivel hinge on a cast-iron pedestal base, the base being enamelled in art colours. A substantial wire guard protects the element from accidental contact, and the element has been

Fig. 1.—The "Creda" Bowl Fire.

designed to be easily replaceable. The top consists of a spiral wire winding mounted on a fireclay cylindrical support with grooves in which the element rests. The whole element is mounted on a spring support as a safeguard against damage through accidental knocks. It is quite a simple matter to either change the element, complete with the fireclay support, or to fix upon the support a new spiral element. The loading of the element is 600 watts.

The "Baby Spot" Projector.

The British Thomson-Houston Co., Ltd., 77, Upper Thames Street, E.C. 4, has recently produced a miniature spotlight projector intended to meet the demand for a spot lamp equipment for use with gasfilled concentrated filament lamps. Designed primarily for theatre lighting, the "Baby Spot" (fig. 2) can be used in many other fields of lighting work. For instance, it is eminently suitable for the spot lighting of special articles in store windows, and for the illumination of kinema corridors, clock faces, indicators, small posters, signs, &c. Although its total weight, including brackets, is only 5 lb. 11 oz., it is very strongly constructed.

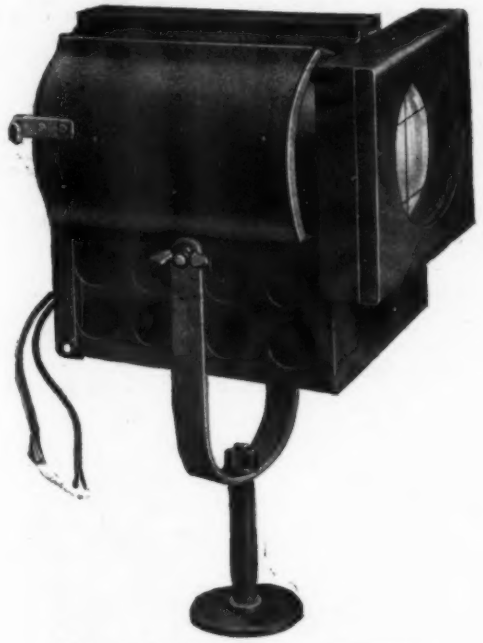


Fig. 2.—The "Baby Spot" Projector.

The body is of sheet steel, enamelled dull black, and the component parts comprise a mirror glass reflector, with copper back, painted with elastic enamel, focusing device, porcelain holder, lens, and universal bracket. The reflector is of such a radius that light reflected therefrom reaches the lens at the same angle as light given direct from the filament. The lens is plano-convex in form, and 4 in. in diameter, and is arranged to give a parallel beam with the lamp in focus and a wide beam when the lamp is moved forward. By loosening a wing nut on the underneath portion of the body, the lamp can be moved forwards or backwards according as a "spotting" or "flooding" effect is desired. This wing nut secures both reflector and lamp in any desired position. The apparatus is very compact, and is thoroughly ventilated. A slide is fitted in front of the lens so that colour mediums may be used when required. This slide attachment is so arranged that it in no way interferes with the beam of light. By a single operation, the colours can be changed as desired in a few moments.

The Kohler Lighting Plant.

Yet another plant for supplying electricity for lighting and power purposes in country houses, farms, &c., has been added to the list of such outfits that are now obtainable in this country—namely, the Kohler d.c., 110-volt plant that comes from the U.S.A. (London representative: Mr. C. H. Cook, 329, High Holborn, W.C. 1). This automatic outfit (fig. 3), which we had the pleasure of inspecting recently, has a capacity of 1.5 kW. A special trip to start or stop the engine is not necessary. Whenever any lamp or switch in the line is turned on, the engine responds at once, and conversely when the last lamp is switched off the plant stops automatically. This feature is obtained by a special controller whose sequence of operation is as follows: On switching on a lamp in any part of the line a battery circuit is completed which motors the generator and so starts the engine; when the latter has reached a certain speed the battery is disconnected and then, after a pause to allow the generator to build up its voltage, the line circuit is completed. The only battery used is a small 24-volt starting battery of the automobile type which is provided with a charging coil so that it is always kept charged and ready for use. The engine is rated at 3.5 h.p. at 1,000 r.p.m., and has four cylinders, and is very smooth running and free from vibration. The outfit is plunger pump lubricated and water cooled on the thermo-siphon system, the radiator being provided with a cooling fan. The ignition is by h.p. magneto, so that in the event of the starting battery or control switch not functioning properly the set can be started up and run under manual control. The engine is governed by mechanical throttling, the speed remaining constant at all loads, but as the demand is varied so is the consumption of petrol decreased or increased as the case may be. The dynamo is a 4-pole compound-wound machine having a commutator 7 in. in diameter and brushes 1 in. wide by 0.25 in. thick. A simple resistance coil maintains a steady voltage at all loads, and the set is very free from flicker; safety fuses and a main switch are also provided. The dimensions of the outfit are as under: Length, 33.5 in.; height, 34.75 in.; width, 14 in., and its weight when crated is 580 lb., that of the starting battery, also crated, being 125 lb.

Witton-Kramer Bench Drills.

Portable electric tools such as drills, grinders, &c., are being used in increasing numbers as their convenience and economy is more and more realised. The Witton Kramer drills, made by the General Electric Co., Ltd., are good examples of this class of apparatus.

Fig. 4 shows an electric drill mounted as a sensitive bench drill. The solidly built stand is provided with a rising table and a steel standard to carry the drill. Two types are made, one with an ungeared drill running at 1,050 r.p.m. and capable of drilling holes up to ¼ in. in brass and soft metal. The other type has a geared drill running at 510 r.p.m., and will drill holes up to ½ in. in steel.

The type R.3 portable electric drill is also arranged as a bench drilling machine. The stand is of massive design and the sliding head on which the electric drill is carried is fed by means of a lever, a spring return being provided. By removing four screws the drill can be dismounted for use as an ordinary hand drill. This little machine is equipped with a direct current motor consuming 360 watts and running at a

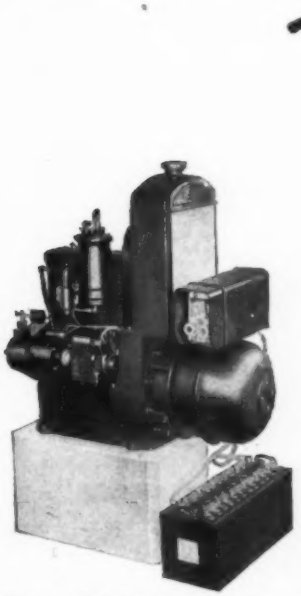


Fig. 3.—The Kohler Automatic Lighting Outfit.

Fig. 4.—A Witton-Kramer Bench Drill.

speed of 500 r.p.m. Its maximum capacity is 29/32 in. in mild steel and the length of feed is 6 in.

The Witton-Kramer series also includes other sizes of drills, magnetic drill posts, grinding outfits, commutator grinding equipments, buffing machines, &c.

New Accumulators.—The *Aftenposten* reports an important invention by the physicist, M. Gross, of Christiania, who, it states, has produced an accumulator with three cells and weighing 25 kilogrammes, which gives a pressure of 6 volts and more than 200 watt-hours per kilogramme, or six times more than the ordinary lead accumulator. It does not freeze and will sustain short circuits that would be calculated to destroy other accumulators. Prof. Vegard, of the Christiania University, thinks there is reason to hope great things of the invention.—*Reuter's Trade Service* (Christiania).

Svenska Dagbladet learns that the Allgemeine Elektrizitaets Gesellschaft, the Siemens-Schuckert, and other important German concerns are forming a new company at Berlin named Warmespeicher Dr. Ruths, for the purpose of exploiting the new "vapour accumulator" of Dr. Ruths, a Swedish engineer.—*Reuter's Trade Service* (Stockholm).

NEW PATENTS APPLIED FOR, 1921.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

26,383. "Automatic electric switch." J. H. Barnett. October 6th.
26,613. "Electric contacts or connections." E. Jones. October 8th.
26,633. "Transmission of electric power by underground cables." A. M. Taylor. October 8th.
26,662. "Automatic control of electric lamps for motor-vehicles, &c." F. G. L. Johnson. October 8th.
26,670. "Magnetic separators." D. C. Sharp and Spencer & Co., Ltd. October 8th.
26,673. "Electron-discharge devices." British Thomson-Houston Co., Ltd. October 8th. (United States, October 28th, 1920.)
26,729. "Electric irons." Phi-Kappa Syndicate, Ltd., and D. Watson. October 10th.
26,744. "Telephonic apparatus." S. M. Hyman and W. A. Saxby. October 10th.
26,746. "Electric ignition apparatus." E. H. Cardwell. October 10th.
26,751. "Ignition and lighting systems for automobiles, &c." M. Feldine. October 10th. (United States, October 8th, 1920.)
26,766. "Electric switches." H. Hurst. October 10th.
26,768. "Electric connections." G. Oldham and J. Oldham. October 10th.
26,780. "Electrical entertainment devices." C. Dinnebier. October 10th. (United States, October 9th, 1920.)
26,793. "Process for manufacture of electrodes." H. Bardt. October 10th.
26,797. "Insulators." J. F. Scheid and H. Schomburg & Sohne Akt.-Ges. October 10th.
26,801. "Electric storage batteries." H. Bardt. October 10th.
26,802. "Apparatus for influencing electric waves produced by cathode tubes for telephony." Dr. E. F. Huth Ges. and L. Kühn. October 10th. (Germany, December 2nd, 1919.)
26,807. "Rectification of alternating electric currents." American Radio and Research Corporation. October 10th. (United States, October 8th, 1920.)
26,820. "Reflecting device for electric lamps, &c." S. H. Gurney. October 11th.
26,821. "Relays and apparatus connected therewith, for amplification of sound, &c." F. W. Baynes and Mechanical Supplies, Ltd. October 11th.
26,830. "Bends, elbows, and sets for tubing for electric wires." T. Atkinson. October 11th.
26,836. "Arrangements for indicating position of apparatus or condition of circuits at a distance." Automatic Telephone Manufacturing Co., Ltd., J. R. Beard, Electrical Improvements, Ltd., and A. E. Hudd. October 11th.
26,841. "Electric contact makers." C. J. L. Moore. October 11th.
26,852. "Ironclad electric switches." W. L. Barber and Midland Electric Manufacturing Co., Ltd. October 11th.
26,853. "Adjustable time-lags for electric circuit breakers, &c." W. L. Barber and Midland Electric Manufacturing Co., Ltd. October 11th.
26,887. "Current transmission devices for ball bearings in electrically-driven rail vehicles." J. Schmid Roost, Ball Bearing Works, Ltd. October 11th. (Switzerland, November 6th, 1920.)
26,892. "Electrical signalling systems." Western Electric Co., Ltd. October 11th. (United States, October 11th, 1920.)
26,900. "Electricity measuring instruments." H. Lucas and W. C. Turner. October 11th.
26,901. "Electricity measuring instruments." E. J. B. Danks, O. Lucas, and O. A. Miller. October 11th.
26,903. "Transmission of pictures by telegraph or telephone." J. T. Anderson. October 11th.
26,905. "Electric precipitating plants." Siemens-Schuckertwerke. October 11th. (Germany, October 28th, 1920.)
26,927. "Circuit breaker." Lodge Fume Co., Ltd. (Metalbank und Metallurgische Ges.). October 11th.
26,931. "Thermostatic elements." British Thomson-Houston Co., Ltd. (General Electric Co.). October 11th.
26,932. "Electric relays, &c." British Thomson-Houston Co., Ltd. and A. S. Fitzgerald. October 11th.
26,945. "Automatic circuit breakers." C. Pasteur. October 11th. (France, October 12th, 1920.)
26,963. "Electric transmission of power with underground cables." A. M. Taylor. October 12th.
26,976. "Methods of eliminating currents in lead sheathings of electric cables." A. M. Taylor. October 12th.
26,981. "Means for improving current carrying capacity of existing three-phase alternating current cable systems." A. M. Taylor. October 12th.
27,023. "Electrical driving of machines on the constant current series system." G. Austin, J. C. Macfarlane, and W. A. Macfarlane. October 12th.
27,034. "Dynamo electric machines." E. C. Hatcher and T. Rooke. October 12th.
27,045. "Combined expansion joint and clamping support for electrical busbars." P. H. Coales, S. Darby, C. C. Garrard, and A. H. Railing. October 12th.
27,049. "Electric insulators." E. Haefely et Cie Akt.-Ges. October 12th. (Switzerland, November 6th, 1920.)
27,052. "Canopies for electric light fixtures, &c." G. W. Hoar. October 12th. (United States, October 22nd, 1920.)
27,053. "Auxiliary sparking unit for spark plugs." F. E. Wade. October 12th.
27,057. "Electrical apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). October 11th.
27,086. "Wall switch." McGill Manufacturing Co. October 12th.
27,089. "Purifying gas by electricity," Siemens-Schuckertwerke. October 11th. (Germany, October 22nd, 1920.)
27,102. "Electric heating and cooking appliances." R. Wolf and J. Zehetmaier. October 12th. (Germany, October 27th, 1920.)
27,107. "Telegraphy or telephony." Dr. E. F. Huth Ges., S. Loewe, and B. Rosenbaum. October 12th. (Germany, September 15th, 1915.)
27,108. "Method for generating and strengthening oscillations for wirgless telegraphy." Dr. E. F. Huth Ges. October 12th. (Germany, May 17th, 1919.)
27,110. "Electric switches." British Lighting & Ignition Co., Ltd., E. B. Tuppen, and E. O. Turner. October 12th.
27,119. "Electrical connection." P. Tracy. October 13th.
27,121. "Positive contact breaker for motor cars." W. McKnight and C. A. Underwood. October 13th.
27,131. "Electric motors for gramophones." C. Kratt and T. McClelland. October 13th.
27,139. "Portable electric water heaters." L. C. Speed and West Lancashire Electrical Co., Ltd. October 13th.
27,140. "Method of controlling electric water heaters." L. C. Speed and West Lancashire Electrical Co., Ltd. October 13th.
27,145. "Device for varying illuminating power of electric lamps." H. C. Roberts and J. C. Roberts. October 13th.
27,148. "Controller for electrical advertising signs. &c." W. Rise and W. Weir. October 13th.
27,159. "Electric irons." A. Russel. October 13th.
27,160. "Apparatus for changing velocity rotation and relative direction of rotation of two rotatable parts." Lancashire Dynamo & Motor Co., Ltd. October 13th.
27,164. "Apparatus for maintaining equality of speed in two or more motors, &c." Eastern Telegraph Co., Ltd., and K. L. Wood. October 13th.
27,189. "Accumulators." K. Kawakami. October 13th.
27,197. "Electric condensers." G. S. Kemp. October 13th.
27,208. "Mouthpieces or trumpets for telephonic transmitting and receiving apparatus." E. A. Graham. October 13th.
27,209. "Process for production of concentrated nitric acid." Norsk Hydro-Elektrisk Kvaelstofaktieselskab. October 13th. (Norway, October 27th, 1920.)
27,222. "Electric diaphragm warning horn." T. Robinson. October 14th.
27,230. "Brush holders for dynamo-electric machines." A. E. Angold, R. Orsetich, and A. H. Railing. October 14th.
27,231. "Automatic, &c., telephone exchange systems." W. Aitken. October 14th.
27,246. "Electric switches." C. W. Parsons. October 14th.
27,283. "Electric irons." T. D. Finizio. October 14th.
27,284. "Sparking plugs." P. Challis. October 14th.
27,293. "Electric furnaces, &c." J. J. Loke. October 14th.
27,295. "Wireless apparatus for producing continuous oscillations." C. W. Payne. October 14th.
27,308. "Holders for incandescent electric lamps." A. H. Hunt. October 14th.
27,309. "Means for producing oscillations." British Thomson-Houston Co., Ltd. (General Electric Co.). October 14th.
27,310. "Radio receiving systems." British Thomson-Houston Co., Ltd. (General Electric Co.). October 14th.
27,311. "Combined coating and winding machines." British Thomson-Houston Co., Ltd. (General Electric Co.). October 14th.
27,324. "Electric cut-out apparatus." C. L. Dubois and C. Reynold. October 14th. (Switzerland, October 14th, 1920.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1920.

10,078. "Signalling apparatus for use in mines." J. Ross and A. Ross. April 10th, 1920. (169,473.)
14,361. "Dynamo-electric machinery." H. K. Whitehorn. May 26th, 1920. (169,482.)
16,311. "Sparkless disconnection of conductors traversed by electric currents." Siemens-Schuckertwerke Ges. October 9th, 1915. (Addition to 145,072.) (145,073.)
16,382. "Process and apparatus for the production of Rontgen rays." J. E. Lilienfeld. April 9th, 1918. (145,084.)
16,918. "Telegraph cables." H. W. Sullivan. June 22nd, 1920. (169,484.)
17,049. "Electric suspension insulators." Siemens-Schuckertwerke Ges. November 29th, 1919. (154,877.)
17,077. "Electric battery lamps." F. J. Turquand. June 23rd, 1920. (169,503.)
17,085. "Electrically-operated speed regulators." Duplex Engine Governor Co., Inc. June 23rd, 1919. (146,136.)
17,233. "Methods and apparatus for use in locating submerged vessels and other submerged and subterranean magnetic bodies." R. A. Fessenden. December 12th, 1918. (146,155.)
17,319. "Electric circuit making and breaking device." E. Schattner. June 25th, 1920. (169,510.)
17,467. "Keys for holding down railway, tramway, tramroad rails, and the like in their supporting chairs." L. Green and W. A. Buyers. June 25th, 1920. (169,518.)
17,580. "Magnetos." Remy Electric Co. December 17th, 1919. (155,796.)
17,735. "Method of starting continuous current motors." Oesterreichische Siemens-Schuckertwerke. January 29th, 1916. (145,589.)
18,070. "Electric bell and the like indicators." M. J. Railing, C. W. Saunders, and J. H. Collings. July 2nd, 1920. (169,535.)
18,335. "Electric welding electrodes." British Thomson-Houston Co., Ltd. (General Electric Co.). July 2nd, 1920. (169,538.)
18,584. "Electrical accumulators." Saunders Electrical Co., Ltd., and C. Saunders. July 5th, 1920. (169,541.)
19,009. "Electron discharge devices." General Electric Co., Ltd., and M. Thompson. July 6th, 1920. (169,546.)
19,196. "Wireless signalling systems." British Thomson-Houston Co., Ltd. October 29th, 1913. (147,147.)
19,243. "Electric contact thermostats." Vapor Car Heating Co., Inc. January 19th, 1918. (147,177.)
19,529. "Overload electric switches." F. Krupp Akt.-Ges. May 15th, 1919. ((147,592.)
19,549. "Electrical systems and apparatus for inducing chemical action." W. J. Rickets. July 8th, 1920. (169,548.)
19,811. "Contact members for vibrating current controlling regulators." V. G. Apple. February 14th, 1918. (147,783.)
19,816. "Armature construction." V. G. Apple. April 27th, 1918. (147,788.)
19,863. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. October 13th, 1915. (147,818.)
19,993. "Subaqueous sound producer and receiver." Signal Ges. November 1st, 1916. (147,938.)
20,363. "Sound producing or receiving devices." Signal Ges. August 4th, 1919. (Addition to 147,939.) (149,324.)
20,415. "Electric resistance connections. F. Krupp Akt.-Ges. November 21st, 1918. (148,458.)
20,809. "Receiving arrangement for the reception of electro-magnetic waves." M. C. A. Latour. October 21st, 1916. (148,951.)
20,810. "Inductances." M. C. A. Latour. December 12th, 1918. (148,952.)
21,027. "Manufacture of coils suitable for use in the construction of static transformers." British Electric Transformer Co., Ltd., and J. Roothaan. July 12th, 1920. (169,553.)
21,619. "Apparatus for the distance control of electric switches by means of light radiations." E. Schattner. July 19th, 1920. (169,563.)
21,666. "Secondary electric clocks." L. Pillon. July 19th, 1920. (169,564.)
21,912. "Alternating current meter." L. Adamczok. July 22nd, 1919. (149,348.)
22,100. "Electric suspension insulators." Siemens-Schuckertwerke Ges. January 6th, 1920. (Addition to 154,877.) (156,567.)
22,295. "Electrical switch gear for controlling the supply of electricity to operate machinery and the like." W. de Renzi. July 27th, 1920. (169,575.)
22,685. "Method of measuring the lengths of electric waves." Nerbonne *née* Armagnat), C. M. A. de Vauve, S. M. T. Armagnat, and P. J. Armagnat. July 30th, 1920. (169,582.)
23,896. "Thermostats." F. J. Heideman, P. M Fowl, H. R. Krueger, and C. E. French. August 16th, 1920. (169,594.)
24,356. "Electric service lifts." E. R. Elliston. August 21st, 1920. (169,604.)
24,755. "Automatic electric sub-station systems." Metropolitan-Vickers Electrical Co., Ltd. (Westinghouse Electric & Manufacturing Co.). August 26th, 1920. (169,609.)
24,773. "Means for regulating alternating currents." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). August 26th, 1920. (169,610.)
27,036. "Timing or distributing mechanism for the electric ignition of internal combustion engines." W. M. Cummiskey. September 24th, 1919. (151,615.)
27,692. "Trolley heads for electric traction vehicles." Shanghai Electric Construction Co., Ltd. (D. McColl). September 29th, 1920. (169,627.)
33,437. "Electric transformers for feeding metal vapour rectifiers." Soc. Anon. Brown, Boveri et Cie. November 27th, 1919. (154,545.)
35,175. "Safety fuses for electric circuits." E. Antinoro. December 14th, 1920. (Addition to 151,523.) (169,640.)

1921.

367. "Electric cartridge fuse." A. L. Eustice. July 23rd, 1914. (156,492.)
1,612. "High ohmic resistance." F. Kruger. November 27th, 1919. (157,909.)